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DEVOTED TO THE CONVERSION, TRANSMISSION and DISTRIBUTION OF ENERGY.

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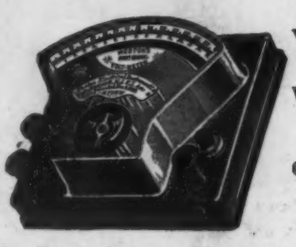

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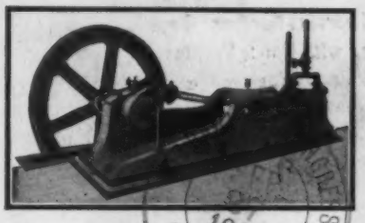

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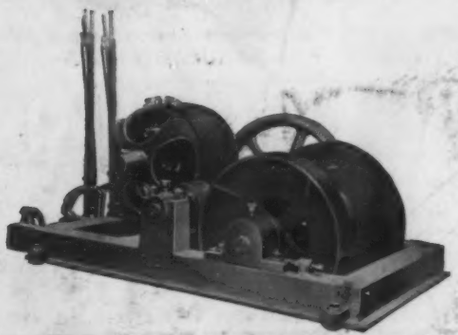

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280

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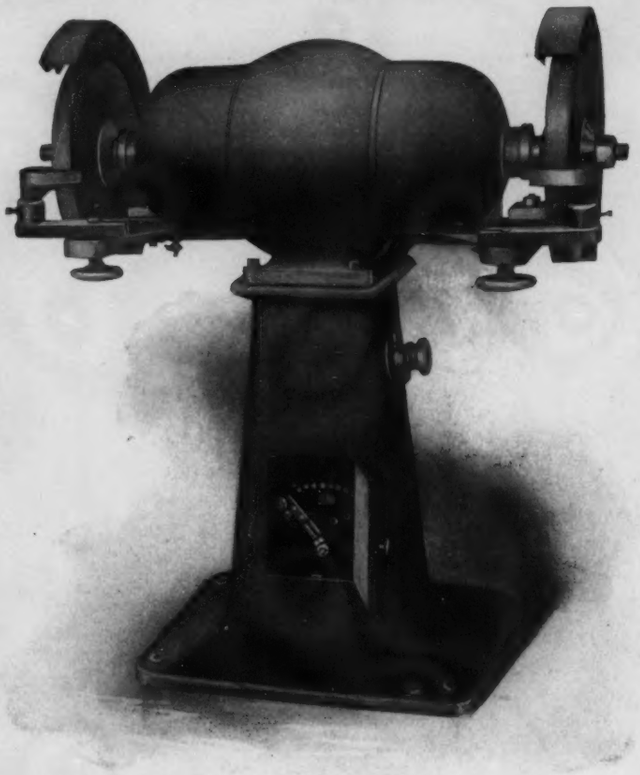

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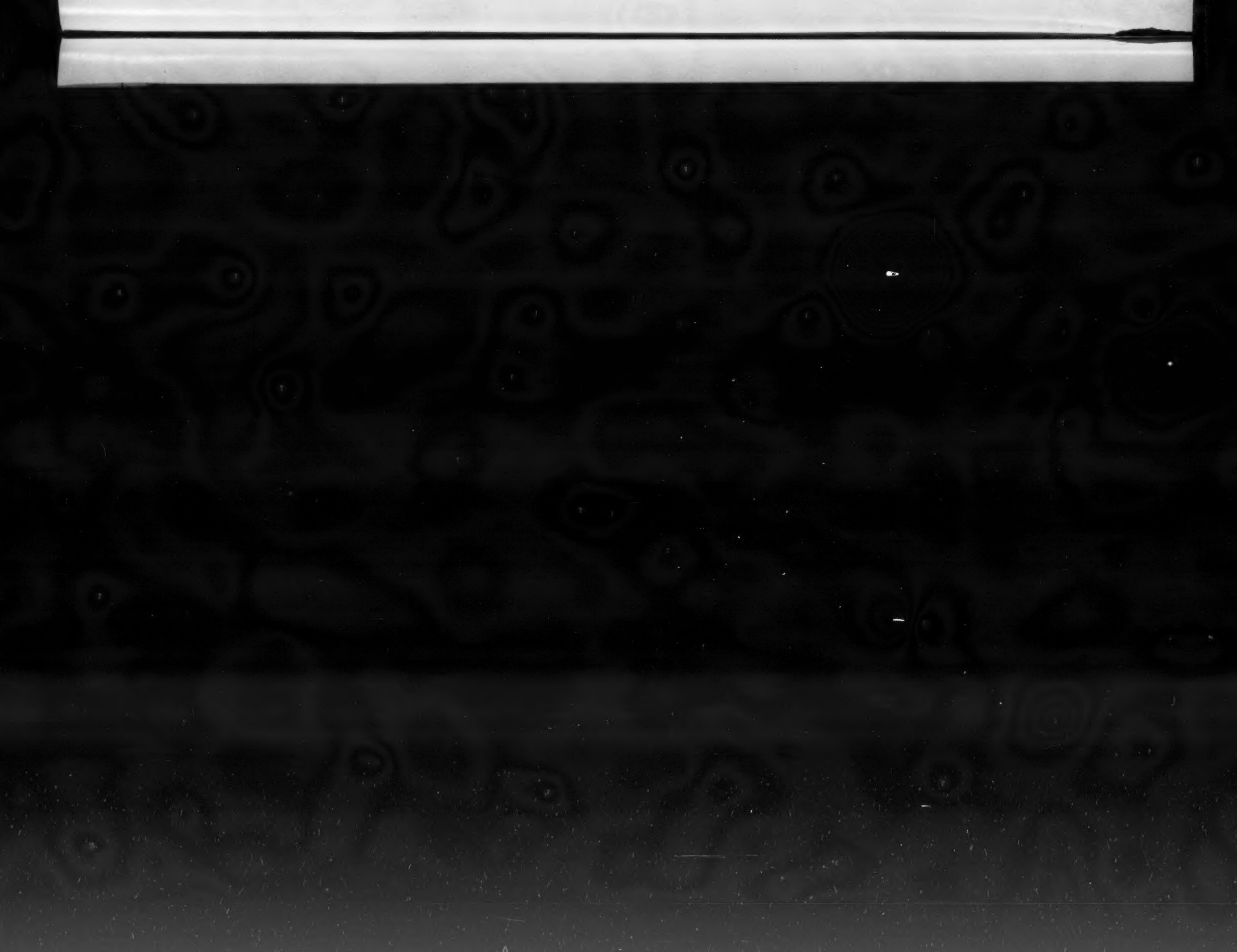


The Journal of Electricity, Power and Gas.

Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XIV. SAN FRANCISCO, CAL., SEPTEMBER, 1904. NUMBER 9

The Guanajuato Hydro-Electric Transmission.[*]

BY ROBERT McF. DOBLE.

THE accompanying sketch map, figure 1, shows the location of a notable hydro-electric power development and high potential long-distance transmission, recently completed in the States of Michoacan and Guanajuato, Republic of Mexico. This plant is a very interesting one, because of its many advanced engineering features, the remarkably short time within which it was constructed, and the fact that the work was completed within the estimates of cost.

Under a concession from the Department of Encouragement, Colonization and Industry of the Republic of Mexico, the Guanajuato Power and Electric Company constructed a canal, pipe line, power generating station, transmission line, sub-station, and distributing systems for developing and marketing the energy of 8,000 liters (283 cubic feet) of water per second, diverted from the Duero River at the confluence of the Camecuaro and Chilchota Rivers, and returned above the Chaparacho Dam.

The following are some of the distinctive features. The head works, canal and power-house are of massive and permanent construction. Special arrangements are made for regulating and measuring the water and for collecting and disposing of the detritus carried by the water during the rainy season. The pressure pipe is large, conducting the water at a low velocity. It has no horizontal bends, and only a few vertical bends, all made with long radii. It is bedded in masonry at each end and is laid in a deep trench and completely covered. It terminates at the bottom in branches leading directly to the water wheel nozzles. The nozzles are the largest yet used. The hydro-electric generating units have two 1,125 horse-power water wheels mounted directly on the ends of the generator shaft and overhanging the two bearings. Energy is transmitted at 60 kilovolts a distance of 101 miles, over 19-strand hard-drawn copper cables, carried on specially designed porcelain insulators larger than any heretofore used. It is the first long span steel tower transmission line.

The inception and development of this enterprise are interesting. Some three or four years ago, Mr. Leonard E. Curtis, who had been for a long time counsel in patent matters for the Westinghouse Electric and Manufacturing Company, and who had been obliged to leave New York and go to Colorado on account of his health, was sent to Guanajuato by clients to examine the title to certain mining properties there. In the course of this examination he became interested in the place, and was impressed

[*] A paper read before the Eighth Annual Convention of the Pacific Coast Electric Transmission Association, Monterey, Cal., June 21-22, 1904.

with the very high cost of the power used for mining operations. Being familiar with modern developments in long-distance electrical transmission, it occurred to him that the conditions there were exceedingly favorable for the introduction of electric power if a suitable water power could be found within working distance. He employed a young American, whom he found there, to search for a water power, giving him a radius of one hundred miles from Guanajuato to work in. The water power which has since been developed was found and an option obtained on it during the following year. In the meantime Mr. Henry Hine, under whose management the Stanley Electric Manufacturing Company had been built up, and who had resigned his position in that company when the ownership of it changed hands, had joined Mr. Curtis in Colorado, and the two had taken up the installation of power transmission plants together. After making a preliminary examination, they presented the matter to prominent capitalists at New York and Boston, who quickly subscribed the necessary capital, subject to an engineering examination. This examination was made by Mr. Robert McF. Doble of San Francisco, Mr. H. H. Filley of Kansas City, and Mr. Charles T. Main of Boston. Their report was favorable, and the company was organized and proceeded with the construction work. Mr. Filley was employed as Chief Engineer of the company, Mr. Doble as Consulting Engineer, and Mr. Norman Rowe, formerly with the Westinghouse Company, was put in charge of the construction work at Guanajuato, and now has charge of the plant as General Superintendent.

PHOTOGRAPH NO. 2. THE TANGANCIOUARO VALLEY

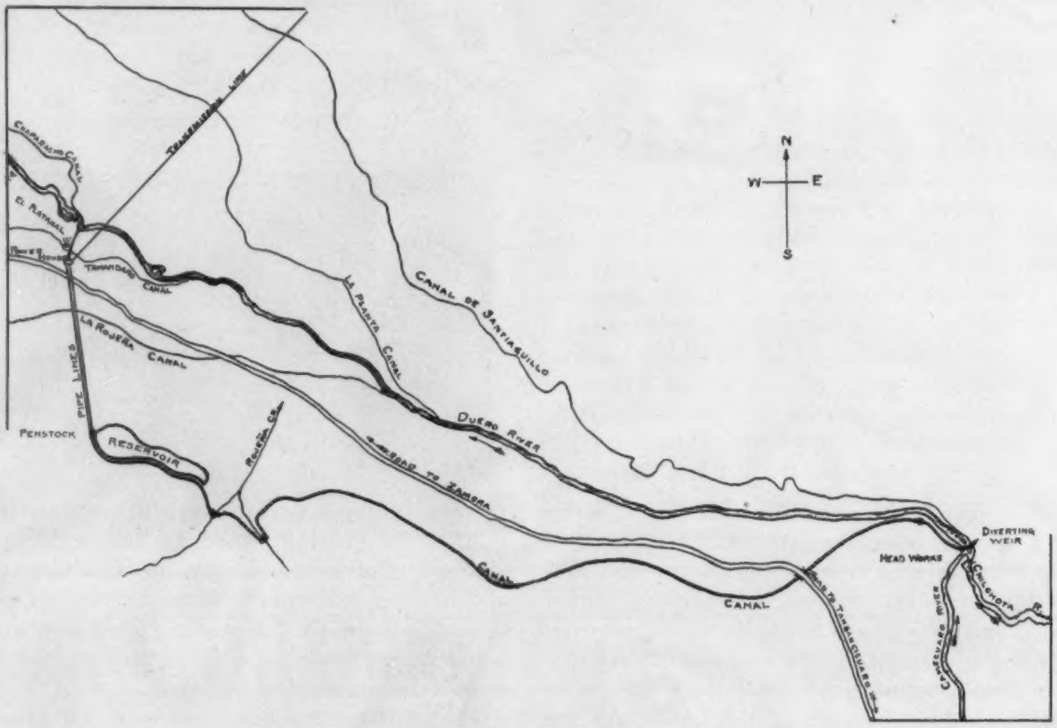


FIGURE 5. SKETCH MAP OF CANAL, SHOWING PLAN OF DEVELOPMENT

The designs and specifications were prepared in San

Francisco. The iron work for the canal and the massive steel pipe-line were ordered from Messrs. Joseph T. Ryerson & Son of Chicago. The plates for the pipe-line were made in Germany, transported by sea to New Orleans, up the Mississippi River and by rail to Cudahy, Wis., and shaped and riveted in the new and finely equipped shops of the Holthoff Machinery Company there. The water wheels were constructed by the Pelton Water Wheel Company in the staid old Quaker City of Philadelphia. The electric generators and transformers were built at the great factory of the General Electric Company at Schenectady, New York. The transmission cables were shipped from the shops of the Ansonia Brass and Copper Company at Ansonia, Conn. The steel towers supporting the cables were manufactured by the Aermotor Company at Chicago. The insulators were made by the Locke Insulator Manufacturing Company at Victor, New York. The poles for the distributing circuits were bought in Texas, and the Portland cement for the masonry was brought in from Germany. From these various sources the materials came by sea and by land to the railway station at the quaint Mexican city of Zamora, whence they were hauled on wagons.

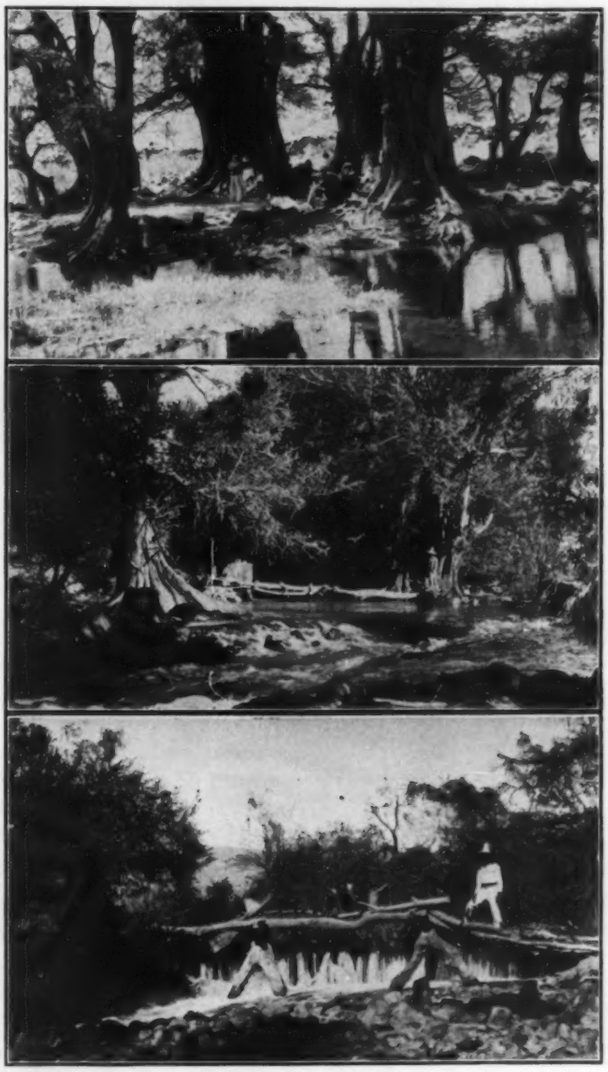
The watershed which supplies the Duero River has never been thoroughly explored. Its area is estimated at 400 square miles; it extends to the Continental Divide, and includes high timbered mountains and land-locked lakes. This portion of the State of Michoacan is a series of fertile valleys, lying one above the other, very like a series of vast terraces. The elevation is from 5,000 to more than 12,000 feet above sea level.

About ten miles to the south of the Zamora Valley, and about 400 feet higher in elevation, lies the broad, beautiful and fertile valley of Tangancicuaro, beyond which, to the south, at a greater elevation lies the valley of Los Once Pueblos (the eleven villages). The Tangancicuaro Valley is nearly surrounded by mountains, which toward the south are timbered and reach an altitude of from ten thousand to twelve thousand feet. Lake Patzcuaro, a large and deep lake with no known outlet, is located high up in this mountain range.

The entire area is of volcanic origin. The rain waters falling upon the high mountain lands penetrate the crevices in the basalt, slowly percolate to lower impervious strata, and then issue from the springs which abound in the valleys mentioned. The catchment area is so extensive and the distance which the water probably traverses so great that the subterranean reservoirs yield an exceedingly uniform volume through the numerous springs, which, during the dry season, furnish the entire volume of the Duero River. Such geological formation and source of supply for a river of considerable and of uniform discharge is not without a parallel, though somewhat uncommon. Similar cases may be found in the lava districts of northern California.

The Duero River is formed by the confluence of the Camecuaro and Chilchota Rivers, which unite at the northerly edge of the Tangancicuaro Valley just above where a low ridge of basalt crosses between the neighboring mountains. Through a break in this formation the river commences its rapid descent into the Zamora Valley, about 400 feet below. The Chilchota branch, with its many tributaries, extends in several directions throughout the Tangancicuaro Valley and to the similar valleys terraced above it, notably Los Once Pueblos, where are located the Chilchota Springs. It has a very extensive watershed reaching to the high timbered mountains, and from it extensive irrigation is practiced. Hence during the rainy season it becomes a rushing torrent, and during the dry season the demands made upon it greatly diminish its volume. Its banks are closely lined with the sabino, or ahuehuete, trees (see photograph No. 4) and from an eminence its course can be plainly traced through broad wheat fields. (See photograph No. 2.)

The Camecuaro branch is only about a mile in length with practically no catchment area. It is supplied by a large group of springs, the water issuing from the lava



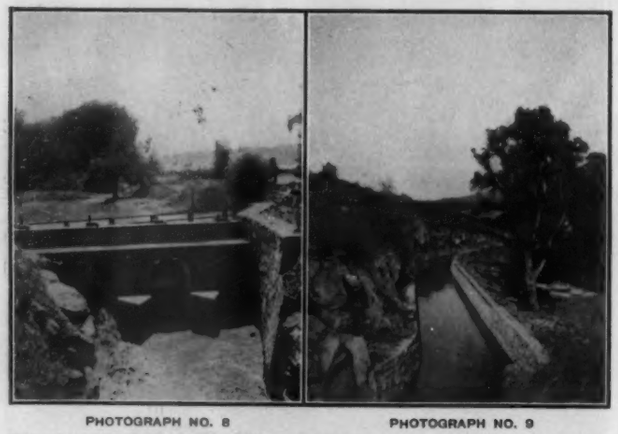
PHOTOGRAPH NO. 3. THE CAMECUARO SPRINGS

PHOTOGRAPH NO. 4. A GAGING STATION ON THE CHILCHOTA RIVER, FOR METER MEASUREMENTS

PHOTOGRAPH NO. 6. THE CHAPARACHO DAM

formation on the northerly side of a low hill. These picturesque springs are surrounded by a fine grove of very large sabino trees (see photograph No. 3), which also closely line the banks and confine the stream within its meandering channel until it unites with the Chilchota. The Camecuaro branch has very little fall from its source to the Chilchota, and it is plainly evident that its volume is remarkably uniform throughout the year. No water is taken from it for irrigation, but at times it receives a small addition to its volume as a result of the excessive irrigation of the wheat fields lying above it with water brought through a ditch from another spring.

A number of careful current meter measurements were made, and compared with figures collected from every possible source, to determine the minimum discharge of the Duero River. Photograph No. 4 shows one of the gaging stations. This data led to the conclusion that there would never be less than a sufficient quantity of water available to warrant the construction of a generating plant of 8,000 electrical horse-power capacity. The possibility of increasing the low water flow by means of storage reservoirs located in the high mountains has not yet been fully investigated.



PHOTOGRAPH NO. 8
THE HEAD WORKS FROM THE DOWN-STREAM SIDE

PHOTOGRAPH NO. 9
THE RATING FLUME

Between the point where the water is taken from the Duero River, namely at the confluence of the Camecuaro and Chilchota branches, to the point where it is returned to the river, namely at the Chaparacho Dam, there are three dams in the river for the purpose of diverting portions of its waters into irrigation canals for the ranches of La Rojena, La Planta and Tamandaro.

The accompanying plat (figure 5) of the river, canal, pipe-line, etc., shows clearly the general plan of development. The native dam shown in photograph No. 6 is in strange contrast with the type of construction now to be described.

The masonry diverting dam is built of volcanic rock, the interior being laid up with lime mortar, and the exterior with Portland cement. It is a curved structure, with a radius of 88.19 meters, the length of the crest being 80 meters. Its elevation is 1,662.40 meters above sea level. It is computed as a gravity dam for a maximum depth of 1.60 meters of water over the crest.

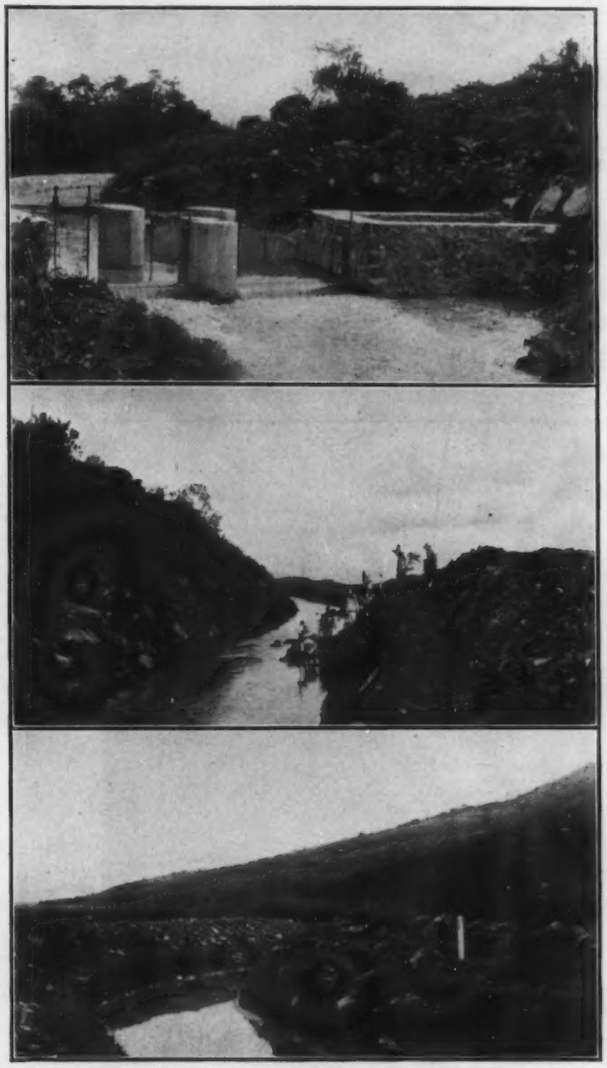
PHOTOGRAPH NO. 7. THE HEAD WORKS FROM UP-STREAM

A heavy steel fender, securely braced against the masonry, protects the entrance to the canal from the drift brought down by the freshets during the rainy season. (Photographs Nos. 7 and 8.) Water is admitted to the canal through four head gates, each with an opening 1.25 by 2.00 meters, at a maximum velocity of about 0.80 meters per second. These head gates run in an angle iron frame set in the concrete. They are made of wood heavily ironed, and are operated through a worm gear which runs on the threaded gate stem like a nut. This worm gear nut is held stationary between ball bearings. The worm which turns it is provided with bronze thrust collars, and is mounted on a spindle having a removable hand crank at one end.

The canal is 6,650 meters long, is of trapezoidal section, 4 meters wide on the bottom and 2.10 meters deep. The side slopes are 1 : 1 in soft earth, 0.5 : 1 in hard rock and 0.2 : 1 where the canal is lined with cement. Its slope is uniform 1 : 2500. Its carrying capacity is 283 cubic feet per second at a velocity of between two and three feet per second.

To provide for accurately measuring the volume of water allowed under the concession, a "rating flume" was constructed near the head works. It is about 100 feet of straight canal, lined with Portland cement held in place by sheets of expanded metal. The top of the wall on the side toward the river is finished with an adjustable metal

PHOTOGRAPH NO. 10. THE SETTLING BASIN AND SUBMERGED WEIR, FROM DOWN-STREAM, DURING CONSTRUCTION



PHOTOGRAPH NO. 11. THE SUBMERGED WEIR AND SETTLING BASIN IN USE

PHOTOGRAPH NO. 12. REPAIRING A LEAK IN THE CANAL

PHOTOGRAPH NO. 13. THE CANAL AT KILOMETER POST 5

weir (photograph No. 9), which is set so as to act as a spillway when more than the proper volume of water is flowing.

A short distance down stream, the canal is widened and deepened, causing a reduction in the velocity of the flowing water to about one-third of the normal, so that any sand may settle to the bottom. This settling basin (photograph No. 10) is provided with six valves opening from its bottom into a culvert which leads out from under the canal to the river. These valves are of new and interesting design, consisting of a circular cast iron opening 18 inches in diameter, closed by means of a conical cast iron bell, drawn point up into the opening from below, and held there by means of a threaded stem and nut, which rests upon two channel beams spanning the canal. By turning the nut the cast iron bell may be lowered to open the valve and wash out the sand which has collected at the bottom.

Immediately below the settling basin there is an adjustable submerged weir, shown quite plainly in photograph No. 11. By means of the head gates and by the adjustable lip at the rating flume, in conjunction with the submerged weir, the quantity of water flowing in the canal may be closely regulated.

At the time the photographs were taken there was very little water flowing in the canal, as it was being filled for the first time to test and to furnish water for puddling the canal.

From this point the greater portion of the canal is of the character shown in photographs Nos. 12 and 13. It meanders along the southerly side of the canyon; under a substantial masonry arch road bridge, 33 feet wide and 16 feet span; over a massive masonry aqueduct, photographs 14 and 15; to a spillway, and thence to a second sand trap (photograph No. 16), near the forebay. The spillway and second sand trap are located so as to make use of the Barranca de la Rojena as a waste waterway leading to the Duero River.

A small storage reservoir (photograph No. 17) is constructed alongside the canal at the forebay, by means of which a sufficient reserve of water is maintained to admit of cleaning the canal when required, and also to carry a very considerable peak load in excess of the normal capacity of the canal.

A simple arrangement is provided for allowing the surplus water to flow into the reservoir from the canal during the hours of light load, and during that time to maintain the maximum head or pressure on the pipe line, regardless of the elevation of the water in the reservoir.

Four suitable automatic gates, like flap valves, are placed in the reservoir, near its bottom, opening outwards into the forebay. So long as the supply of water in the canal is equal to or in excess of the discharge through the water wheel nozzles in the power house, the maximum water level is maintained in the forebay; if there is a surplus of water, it overflows from the forebay into the reservoir over a suitable weir. Whenever the requirements of the water wheels are in excess of the quantity of water flowing in the canal, the water level in the forebay is lowered, relieving the pressure on the outside of the automatic gates, which then open and let the reservoir discharge to make up the deficiency. At the entrance to

PHOTOGRAPH NO. 15. INSIDE THE MASONRY AQUEDUCT

the forebay the water passes over a measuring weir. On passing from the forebay to the penstock the water flows through a screen (photograph No. 18), which removes all floating debris.

The massive masonry penstock is strengthened by iron hoops embedded in its walls, and is interesting because of its excellent hydraulic lines. The water, after passing through the screens and through four gates similar to those at the head works, enters two ellipsoidal masonry basins, which gradually diminish in diameter toward the bottom, merging into the great oval taper sections, which are the heads of the pipe lines (photographs Nos. 19 and 20). This design causes a gradual acceleration in the velocity of the water and also prevents the formation of the whirling vortex which would draw air into the pressure pipes.

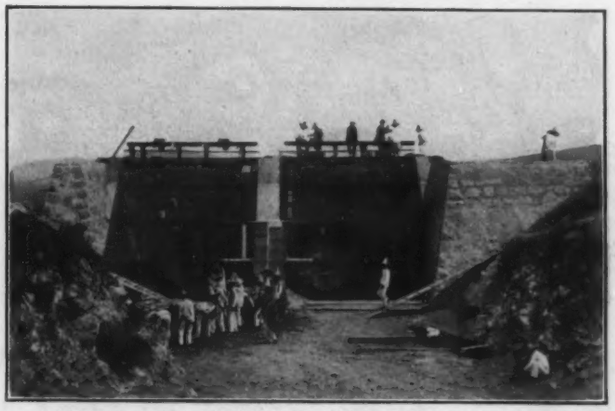
PHOTOGRAPH NO. 17. THE STORAGE RESERVOIR

PHOTOGRAPH NO. 14. THE MASSIVE MASONRY AQUEDUCT

PHOTOGRAPH NO. 16. THE LOWER SAND TRAP AT KILOMETER POST 6

The pipe line is 3,300 feet long, with no lateral bends. It varies in diameter and thickness, as shown in the following table, and was designed with a safety factor of five.

Inside diameter of pipe	Thickness of plate	Approximate length
69 inches	$^{5}/_{16}$ inches	1,100 feet.
63 "	$\frac{3}{8}$ "	1,000 "
63 "	$^{7}/_{16}$ "	100 "
57 "	$^{7}/_{16}$ "	350 "
57 "	$\frac{1}{2}$ "	350 "
57 "	$^{9}/_{16}$ "	200 "
57 "	$\frac{5}{8}$ "	200 "
Total		3,300 "



PHOTOGRAPH NO. 18. THE MASSIVE MASONRY PENSTOCK AND SCREEN DURING CONSTRUCTION

The decrease in the diameter of the pipe sections causes an acceleration in the flow of the water as it descends. This also made possible the nesting of sections for shipment.

The pipe was made up from steel plates, in sections 27½ feet long, and weighing from 7,000 to 10,000 pounds each. The steel plates were carefully selected and tested, the metal being required to have the following characteristics:

Tensile strength: 52,000 to 62,000 pounds per square inch.

Elastic limit: Not less than one-half the tensile strength.

Elongation: 25 per cent.

180 degrees cold quench bend flat on itself without fracture on the outside of the bent portion.

There are 480 separate plates in the pipe, each rolled tapering, the small end of one fitting inside the large end of the one next below it.

All seams were lapped, and the longitudinal seams were designed so as to have at least 70 per cent of the strength of the plate. These longitudinal seams were placed so that they are on top of the pipe and alternately opposite, with the caulking edges up, as shown in photograph No. 21. The longitudinal seams are double riveted; the circular seams single riveted. All the shop riveting was done by a large hydraulic riveter. The field riveting was done by hand by a gang of expert boiler makers sent to Mexico for that purpose. Two riveters, a helper and a man at the forge to heat the rivets could finish one circular seam in a day. When riveted the pipe was caulked and an extra coat of preservative paint was applied. Each section of the pipe had on top near its lower end a hole through which the hot rivets were passed from the forge to the man inside. The hole was tapped and a plug screwed in after the joint was riveted (see photograph No. 21). Each section was plainly marked at the factory with letters indicating its position in the pipe line.

The common practice of laying pipes of this character on top of the ground and supporting them on piers was not followed. A deep trench was dug, the bottom of which was graded on long tangents and with slight vertical angles. The pipe was laid in this trench beginning with the section nearest the power house, and riveting on section after section, working up hill. Bell holes were dug in the bottom of the trench so that the riveters might have room to swing their hammers. The back filling of the trench was done with great care, the earth being dampened and thoroughly tamped under and around the pipe. During the early morning hours, while the pipe was cool and at its minimum length, the top covering was completed (see photograph No. 22).

On August 24, 1903, the pipe was tested, and so well

PHOTOGRAPH NO. 20. LOOKING OUT THROUGH THE MOUTH OF THE GREAT OVAL TAPER SECTION DURING THE CONSTRUCTION OF THE PENSTOCK

PHOTOGRAPH NO. 19. PLACING THE GREAT OVAL TAPER SECTIONS

had the work been done that not a single leak was found, although there are over 70,000 rivets.

The pressure pipe terminates at the bottom of the hill in branching cast iron pipes leading through the south wall of the power house to the nozzles, as shown on the plan, figure 23.

The power house (photographs Nos. 24 and 25) has masonry walls, built of native volcanic rock. The roof is of galvanized iron supported by steel roof trusses and lined with an anti-condensation lining.

As shown by the photographs, it is built in an excavation extending to a considerable depth below the natural surface of the ground. This was done for economical reasons. The pipe line profile is quite flat at the lower end where the pipe line is the thickest and most expensive, and it was concluded that it would be cheaper to excavate a longer length of tail race and to dig deeper for the power house than to extend the pipe line, as each additional foot on the 57-inch pipes 5/8 inch thick would cost a considerable amount. The inside dimensions of the

PHOTOGRAPH NO. 21. BOILERMAKERS AT WORK IN THE FIELD, RIVETING UP THE PIPE

power house are: length, 200 feet; width, 32 feet. The floor is of cement. A low wall separates a length of 40 feet at the easterly end of the building, where the

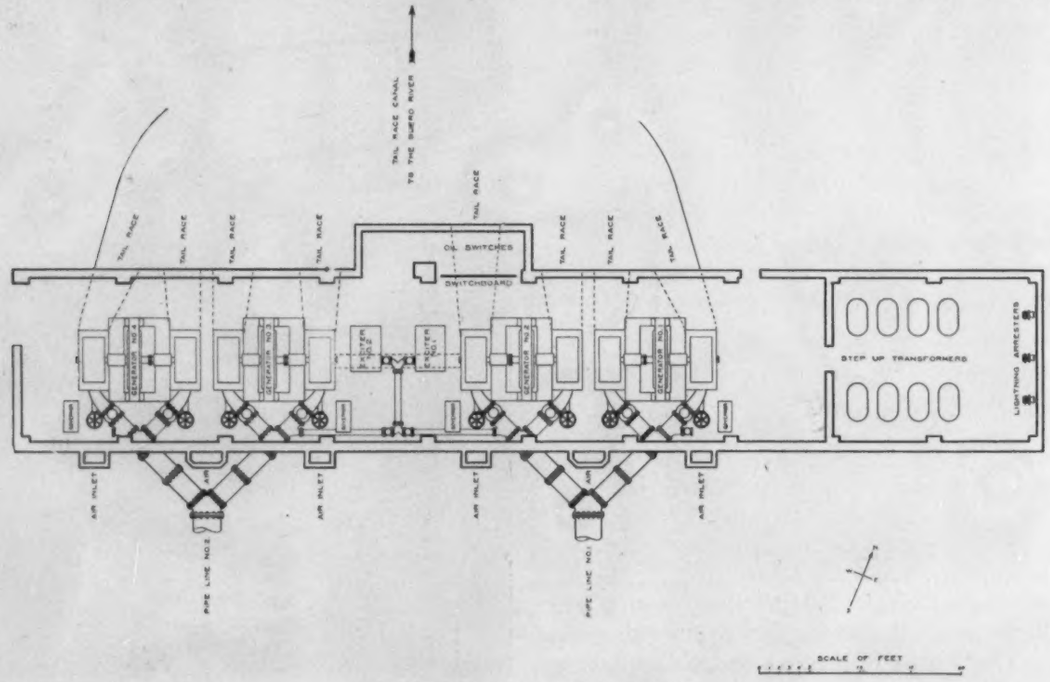
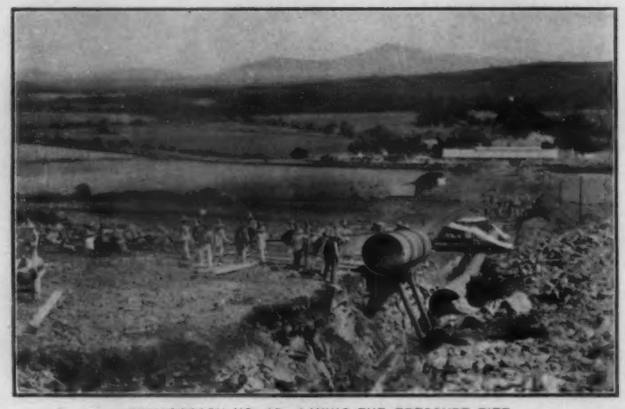


FIGURE 23. PLAN OF GENERATING STATION



PHOTOGRAPH NO. 22. LAYING THE PRESSURE PIPE

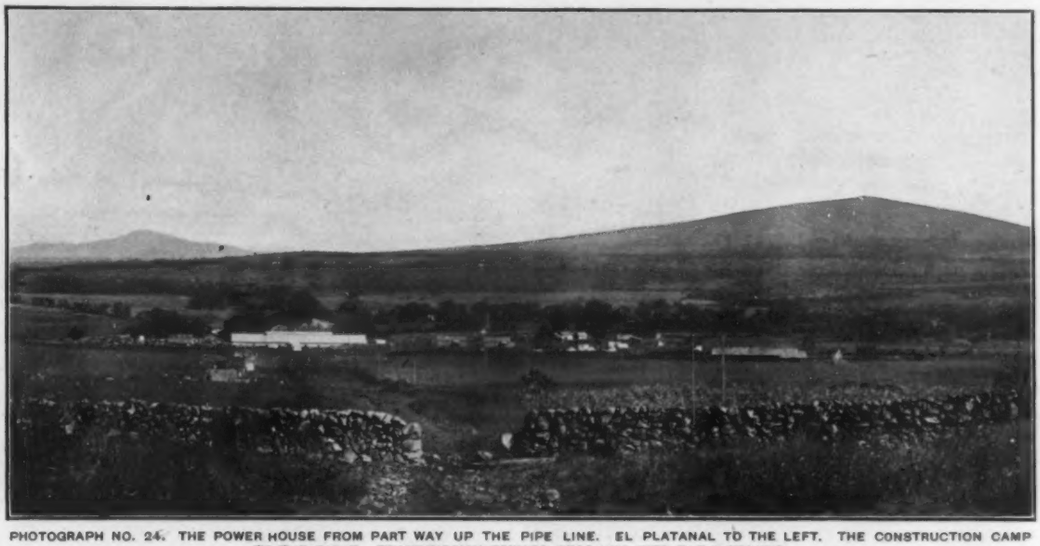
transformers are placed (photograph No. 26), which portion is two feet lower than the main room, and is provided with drains into the tail race.

There are two ten ton hand operated cranes which run the entire length of the building over both generator and transformer rooms. The erection of these cranes was an unusually simple matter. They were rolled into place from the surface of the ground and subsequently constituted the basis of a moveable platform upon which the roof trusses were carried to place.

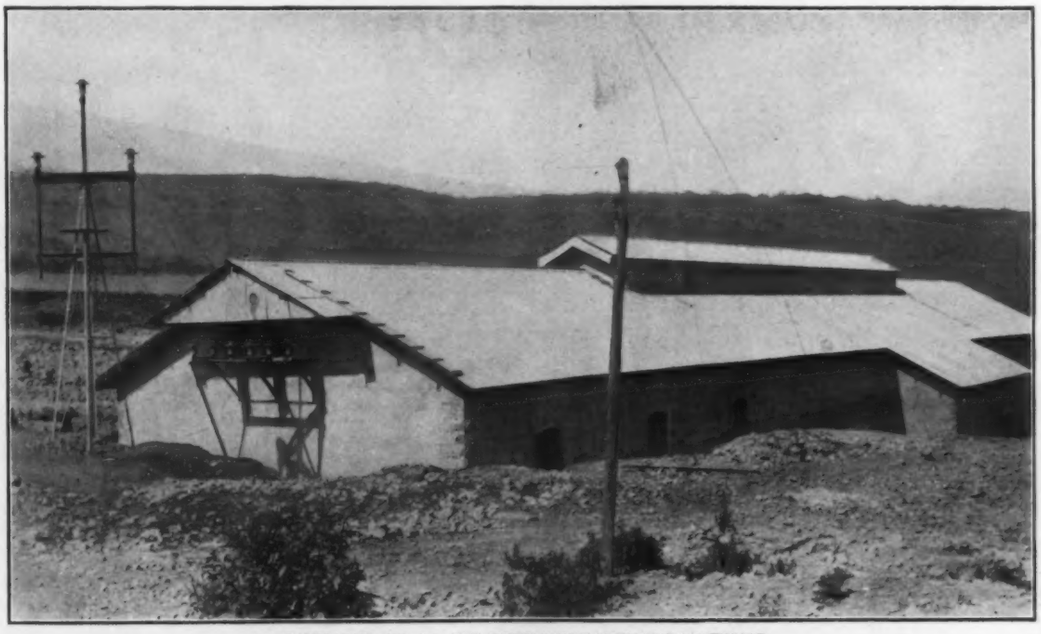
The cast iron branch pipes convey the water to heavy 30 inch gate valves equipped with by-passes. The nozzles are attached to the gate valves as shown in the accompanying plan (figure 23). These pipes are made

of close grained gray cast iron and have lip and recess bolted flange joints with lead gaskets and are entirely buried in concrete.

As shown in the plan, the nozzles are curved in form making a 45 degree bend so as to bring the axis of the jet at right angles to the water wheel shaft. Each nozzle is provided with a removable tip, of cold blast charcoal iron, held in place by means of 14 seven-eighths inch Tobin bronze studs with steel nuts. The nozzle is of the needle regulating type having a core piece moveable axially within it by means of which the annular area of the orifice is changed. The core piece is a Tobin bronze stem with a phosphor bronze bulb fitting into the nozzle tip. A continuation of the stem through a gland in the convex side of the nozzle casting is threaded, and, by means of a bevel gear nut operated through a hand wheel stand the needle is moved in and out to adjust the quantity of water discharged by the nozzle, so that the maximum economy in the use of water may be attained. This construction produces a solid jet of good form and of high efficiency over a wide range of discharge. Each nozzle is equipped with a deflecting hood, operated through a system of levers by a governor, for regulating the speed of the generating unit.



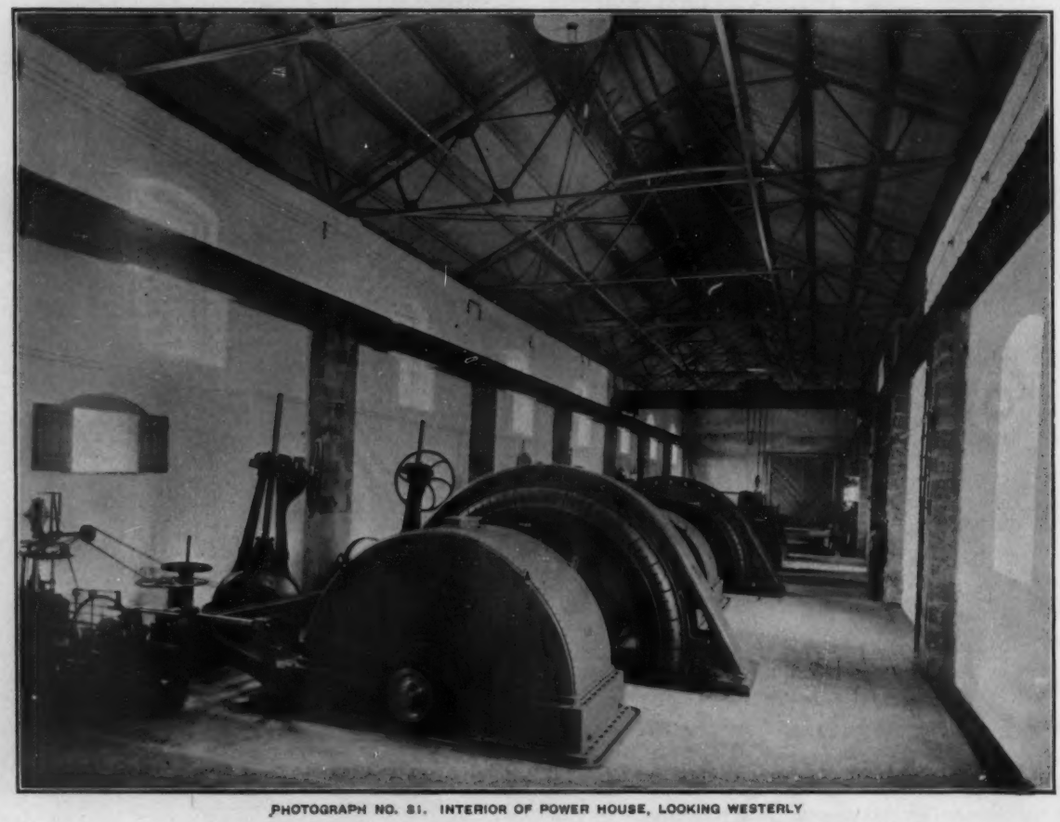
PHOTOGRAPH NO. 24. THE POWER HOUSE FROM PART WAY UP THE PIPE LINE. EL PLATANAL TO THE LEFT. THE CONSTRUCTION CAMP TO THE RIGHT. TRANSMISSION TOWERS REACHING INTO THE DISTANCE



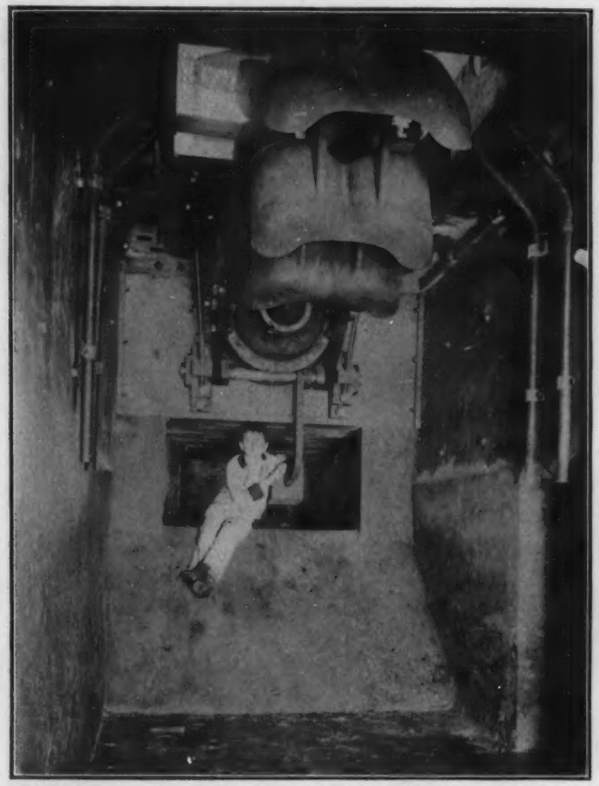
PHOTOGRAPH NO. 25. THE POWER HOUSE FROM THE NORTHEAST

The water emerging from the nozzle tips in solid jets more than half a foot in diameter, at a velocity exceeding a mile and a half per minute, with a pressure of 138 pounds per square inch, is projected into the buckets of

PHOTOGRAPH NO. 20. INTERIOR OF THE POWER HOUSE, LOOKING EASTERLY



PHOTOGRAPH NO. 21. INTERIOR OF POWER HOUSE, LOOKING WESTERLY



PHOTOGRAPH NO. 27. A WATER WHEEL FROM UNDERNEATH, SHOWING AIR INLET

the water wheels (photograph No. 27; also cross section of generating station, figure 28). The discharge into the tail race is shown in photograph No. 29.

Each water wheel has fifteen huge buckets, more than two feet in width and weighing 254 pounds apiece, made of close grained cold blast charcoal iron. The buckets are accurately fitted to the rim of the cast iron wheel centre and secured thereto by means of two fitted steel stud bolts. The entrance edges are sharpened, the hydraulic surfaces are ground smooth and painted and each bucket is brought to a standard weight so as to obtain a dynamic balance. The cast iron wheel centers are machine finished all over, bored taper, keyseated, and secured to the projecting ends of the generator shafts by means of a feather and a large bronze nut, as shown by the longitudinal partial section, figure 30.

The solid carbon steel shaft is 12 inches in diameter from the water wheels through the bearings; being enlarged to 16 inches diameter in the middle portion. The

PHOTOGRAPH NO. 29. THE DISCHARGE INTO THE TAIL RACE CANAL

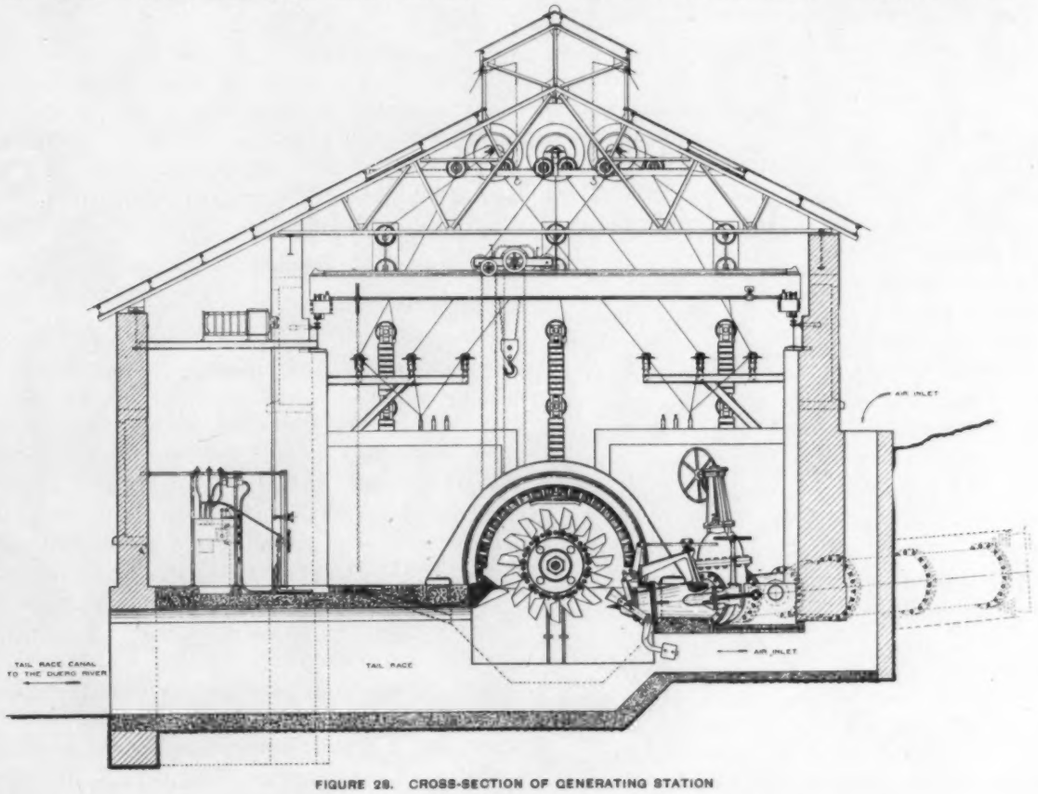


FIGURE 28. CROSS-SECTION OF GENERATING STATION

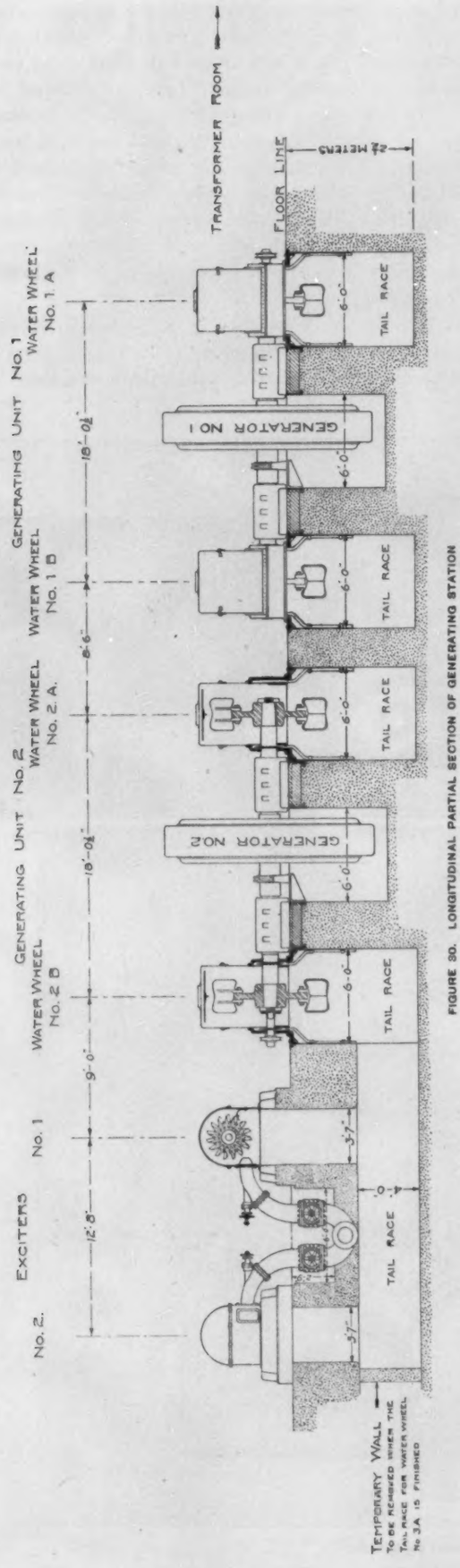
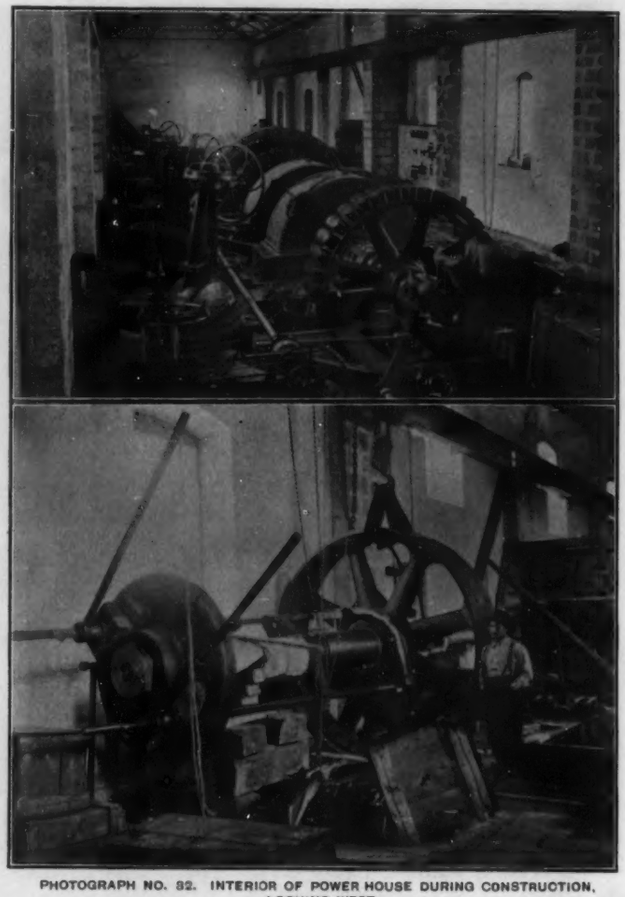


FIGURE 30. LONGITUDINAL PARTIAL SECTION OF GENERATING STATION



PHOTOGRAPH NO. 32. INTERIOR OF POWER HOUSE DURING CONSTRUCTION, LOOKING WEST

PHOTOGRAPH NO. 33. PULLING THE GENERATOR SPIDER AND THE WATER WHEEL CENTER ON THE SHAFT

bearings are 36 inches in length by 12 inches in diameter, of ring oiling water cooled type of special design.

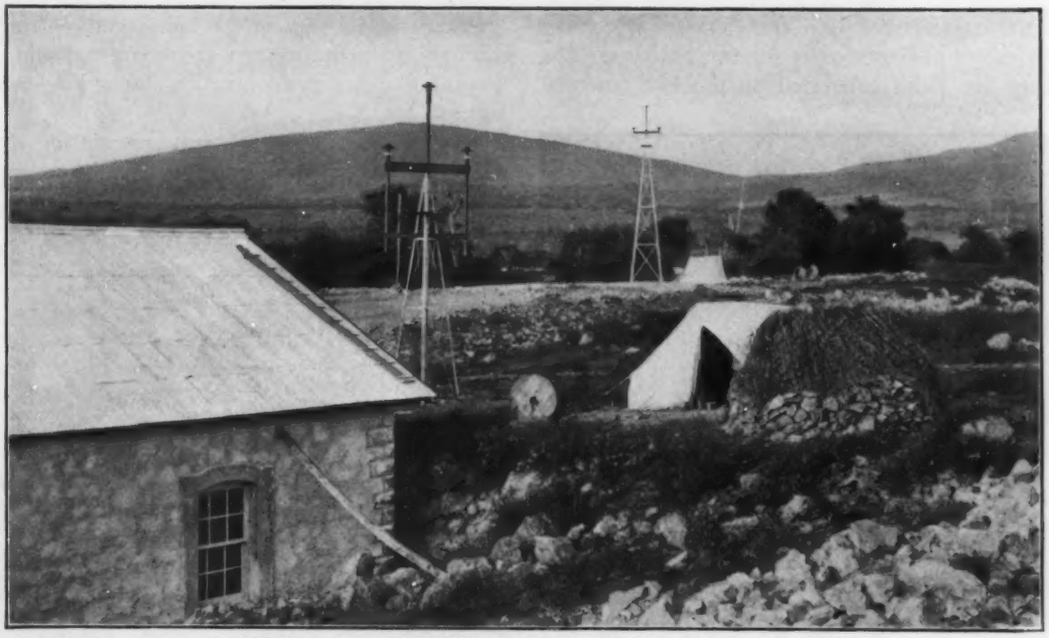
The generators are revolving field, engine type, 2300 volt, 3 phase, 60 cycle, 200 R. P. M. machines, rated at 1250 K. W. but designed for a 25 per cent continuous overload. Their characteristics, as determined by factory test, are as follows:

Full load commercial efficiency.....95.77%.
Three-fourths load .....94.92%.

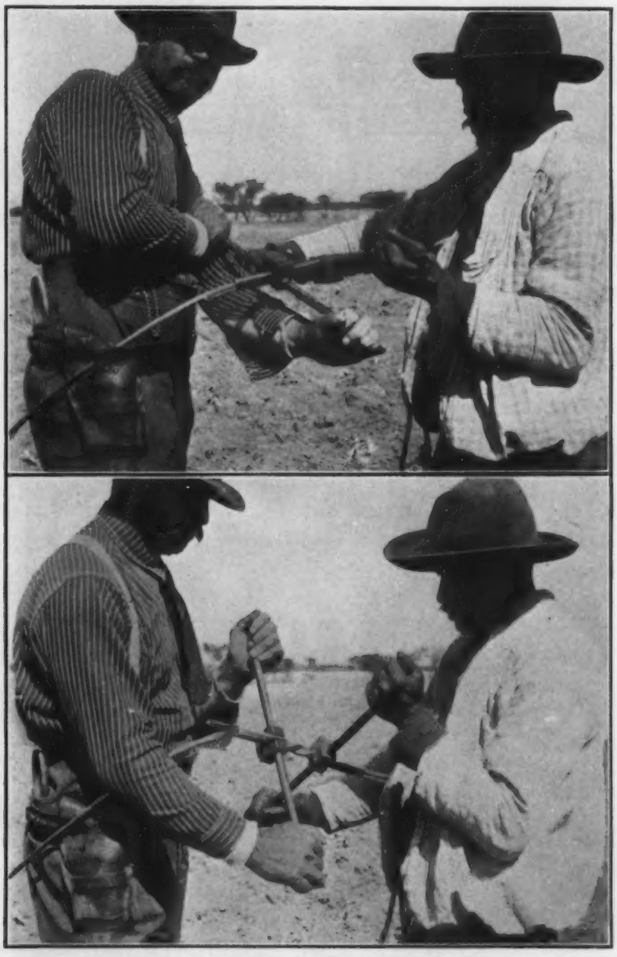
Regulation at full load and 100% power factor is 4.4%, temperature rise of armature 21° centigrade after six hours' full-load operation.

The total weight of the revolving element consisting of the field, the shaft and the two water wheels, is about 50,000 pounds, carried on two bearings. The speed is regulated by means of a governor, operated by an oil pressure system, actuating the deflecting hoods already described. The governors and the oil pressure pumps are bolted from the generator shaft, as shown in photograph 31.

The hydro-electric generating units above described are conspicuous by reason of their compactness and simplicity, there being only the stationary armature, the electric and hydraulic revolving elements mounted on the shaft, and two bearings. The 1250 K. W. unit occupies



PHOTOGRAPH NO. 34. THE TRANSMISSION LINE REACHING AWAY TOWARD GUANAJUATO



PHOTOGRAPH NO. 35. MAKING A JOINT IN THE TRANSMISSION CABLE
A. READY TO TWIST

PHOTOGRAPH NO. 36. MAKING A JOINT IN THE TRANSMISSION CABLE
B. TWISTING

a floor space of only about seventeen feet by twenty-five feet (photograph No. 32).

The assembling of such heavy machinery remote from shop facilities presented some difficulties, and in photograph No. 33 is shown the method employed for pulling on the revolving field spider and the water wheels, by use of specially long threaded steel bolts.

Continuous current for exciting the alternators is supplied by two 120 K. W. 500 R. P. M. self contained hydro-electric units, each of sufficient capacity to excite the four generators; so that one exciter is a spare. The exciter base is extended so as to receive the water wheel housing (photograph No. 26). The water wheel is mounted on the extended end of the shaft overhanging the bearing. Water is supplied to the wheel through a hand regulating needle nozzle, being conveyed from the main branch pipe as shown by the plan, figure 23.

The current is conveyed from the generators to the switchboard, and thence to the step-up transformers, through lead covered rubber insulated copper cables laid in shallow covered ducts in the cement floor. The current passes from the generators through 600 ampere oil break switches, each installed in a separate concrete compartment, to the 2300 volt bus-bars.

The field rheostats are supported on 4-inch I beams above the switchboard and are operated by means of chains and sprocket wheels. The bus-bars, oil switches, and wiring for the instruments are all back of the board and out of the way being located in an alcove on the north side of the building, as shown in the plan, figure 23, and in photographs Nos. 26 and 32. The switchboard has seven marble panels, one for each of the generators, one for each exciter and one for two step-up transformer circuits.

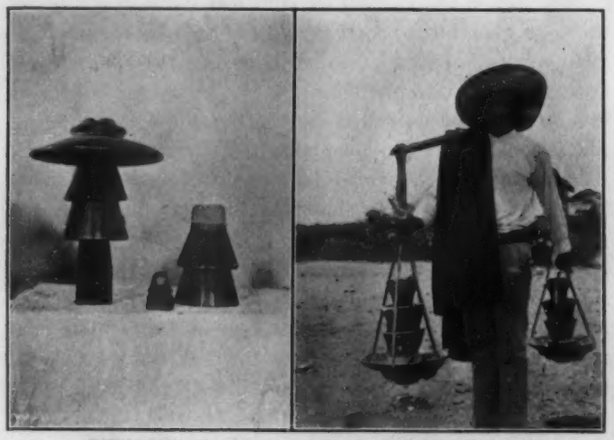
From the switchboard the 2300 volt current is con-

ducted to the 1080 K. W. static transformers where the potential is raised to 60,000 volts for transmission. The transformers are Delta connected on the low potential

PHOTOGRAPH NO. 37. MAKING A JOINT IN THE TRANSMISSION CABLE C. SPLICE COMPLETED

side and "Y" connected on the high potential side, having taps brought out through the top of the tank for line potentials of 40,000, 50,000 and 60,000 volts, the neutral being grounded. The efficiencies of the transformers as determined by factory tests are as follows:

Full load .....98.295%.
Three-fourths load .....98.028%.



PHOTOGRAPH NO. 36 THE INSULATOR AND CROSS-ARM PIN

PHOTOGRAPH NO. 44 CARRYING OUT INSULATORS ALONG THE LINE

The transformers are of the oil insulated water cooled type; the tanks are 9½ feet in height and occupy a floor space of three feet by six feet.

From the step-up transformers the current is conducted to the transmission line, the wires passing out of the building through circular openings in the wall to a set of 60,000 volt disconnecting switches mounted just outside of the building and thence to the first tower of the transmission line as shown in photographs Nos. 25 and 34.

On the inside wall of the building three rows of 60,000 volt lightning arresters are mounted, being connected through switches to the outgoing leads, as shown in photograph No. 26.

The 101-mile 60,000-volt transmission line differs materially in design from any line heretofore constructed,

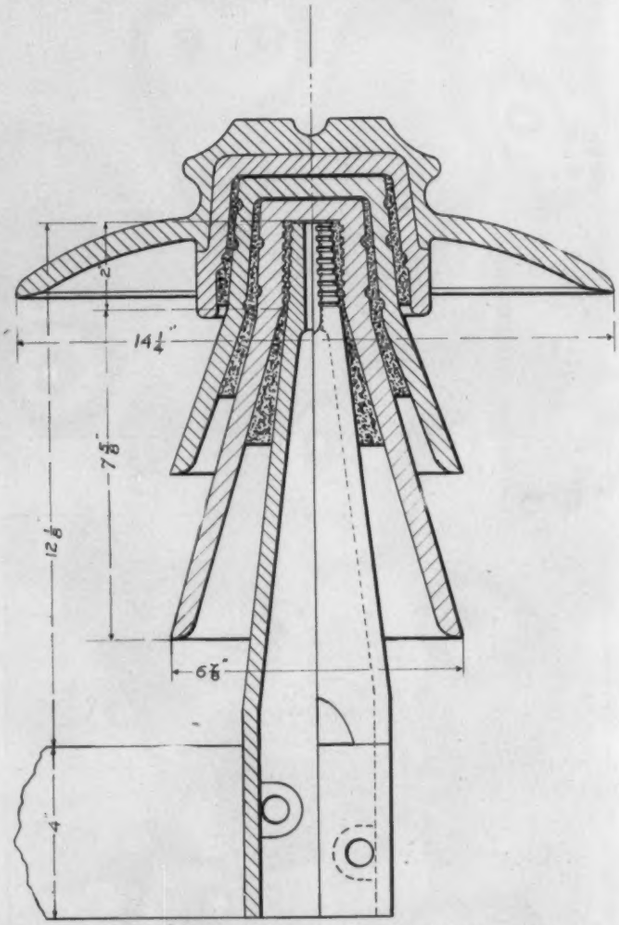


FIGURE 39. CROSS-SECTION OF 60,000 VOLT INSULATOR AND PIN

notably in the use of a hard drawn copper cable instead of the usual solid conductor, metal pins, cross arms and towers for supporting the insulators, and unusually long spans.

PHOTOGRAPH NO. 41. CEMENTING TOGETHER THE INSULATOR PARTS AND THE PINS. A. READY FOR THE NEAT CEMENT

From the power generating station near Zamora the line passes for about 30 miles over rough mountainous lava formation cut by deep ravines. Near Guanajuato also there is some rough country but for about 60 miles the line passes over clear rolling country the most of which is under cultivation.

The conductors are 19 strand, hard drawn copper cables, approximately 3/8 of an inch in diameter, equivalent in carrying capacity to a No. 1 B. & S. G. wire, and weighing 1340 pounds per mile. This type of conductor

PHOTOGRAPH NO. 42. CEMENTING TOGETHER THE INSULATOR PARTS AND THE PINS

was finally determined upon, after much study and many tests because of its high conductivity, flexibility and mechanical strength; the wires composing it having a tensile strength of over 55,000 pounds per square inch. The cable was made and shipped in lengths of about two miles. The joints were made with special copper tube connectors 12 inches long and elliptical in cross section. The two ends to be joined were passed through the connector in opposite directions and three complete twists were given by means of special wrenches. Photographs Nos. 35, 36 and 37 show the making of a joint. No soldering was done. The cables are placed in grooves on top

PHOTOGRAPH NO. 43. AFTER THE INSULATOR PARTS HAVE BEEN CEMENTED TOGETHER, THEY ARE DRIED IN THE SHADE OF THEIR OWN PACKING STRAW

of the insulators, 78 inches apart, at the points of an equilateral triangle, and are tied in with No. 14 soft copper wire, it being considered that the small wire wrapped

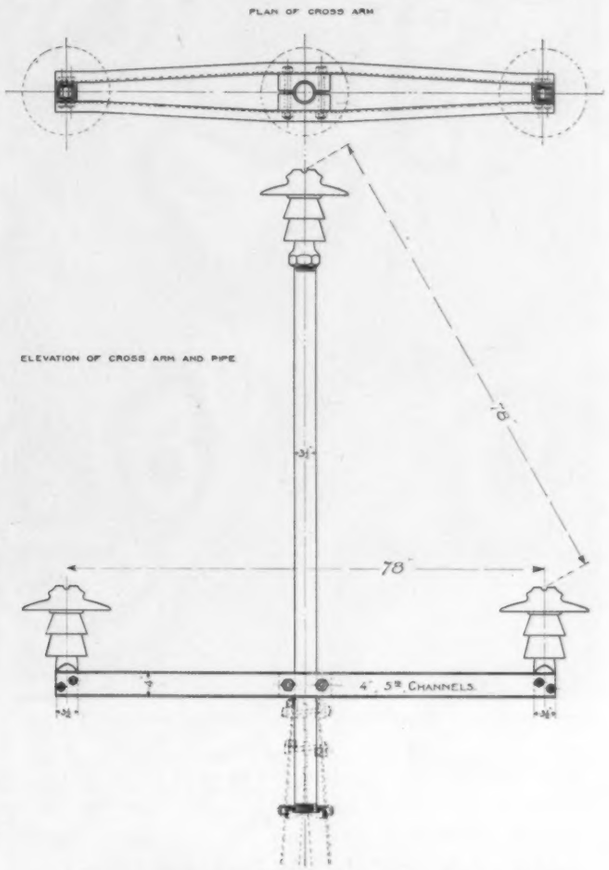


FIGURE 40. SKETCH OF TOP OF TOWER, SHOWING CROSSARM AND PIPE

about several times would make an easy tie and not be apt to damage the small, hard drawn strands of the cable.

The cable was shipped on reels in lengths of about two miles. Where the topography and roads permitted six of the reels were delivered from the wagons each

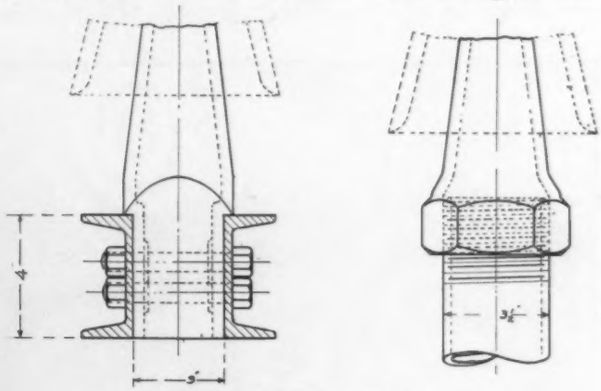
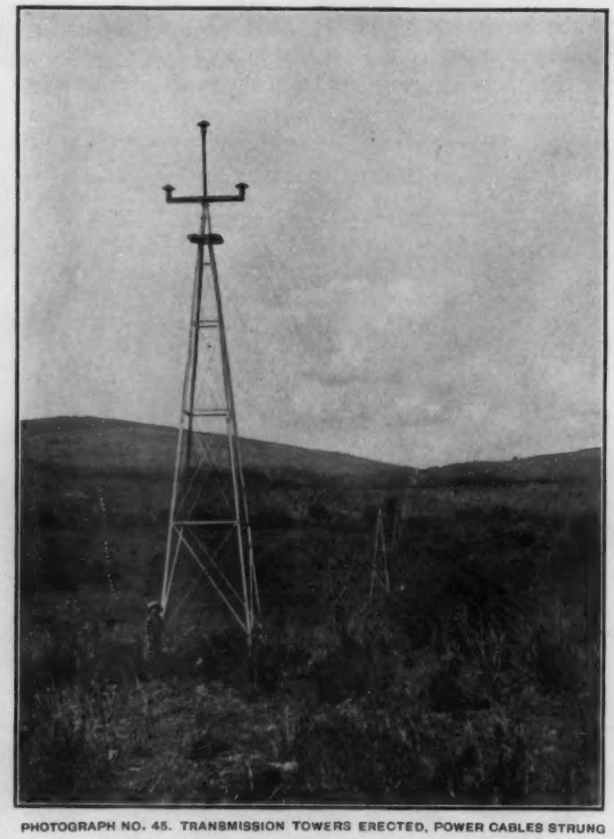


FIGURE 40A. DETAIL OF PIN BASES

four miles. The cables then were pulled out over the cross-arms on rollers and spliced and tied in. In the mountainous sections the cable had to be cut into shorter lengths.



PHOTOGRAPH NO. 45. TRANSMISSION TOWERS ERECTED, POWER CABLES STRUNG

Diagrams showing the proper sag to be allowed at various temperatures and for spans up to 1320 feet, were prepared, based on a maximum strain of 20,000 pounds per square inch, in the coldest weather and with the most severe wind. The calculations include an allowance for the mechanical elasticity of the cable.

The insulators, photograph 38, are larger, heavier and better than any heretofore used and were required to stand a test potential of 120,000 volts for five minutes. They are over 12 inches in height and 14 inches in diameter and weigh about 15 pounds. They are made of porcelain with a brown glaze and consist of four parts, as shown in the cross section, Figure 39. The top and the first petticoat were glazed together in the kiln and the other two joints were made with neat Portland cement. The pins were likewise secured into the completed insulator.

The pins are of cast iron, conical in shape and cored hollow. The pin which carries the top insulator has an enlarged base, threaded on the inside, and is screwed on to the end of the 3½ inch extra heavy pipe, which projects from the top of the tower. The pins which carry the lower insulators have rectangular bases, as shown in photograph No. 38, which are securely clamped between the ends of the four inch channels which constitute the cross-arm, as shown in the sketch of the top of the tower, figures 40 and 40A.

The insulators were shipped in two parts, in barrels, and the cementing together of the parts and the cementing in of the pins had to be done in the field. The method employed is illustrated by photographs Nos. 41, 42 and 43. After the parts were assembled the "field" was covered with the packing straw from the barrels in order to protect the insulators from the hot sun while the cement was hardening. The completed insulators with the pins in place were then carried out from the construction camps to the required location on the line, two at a time, by "man power" as shown in photograph No. 44. This was found to be the most satisfactory and economical method, as human labor is very cheap in Mexico.

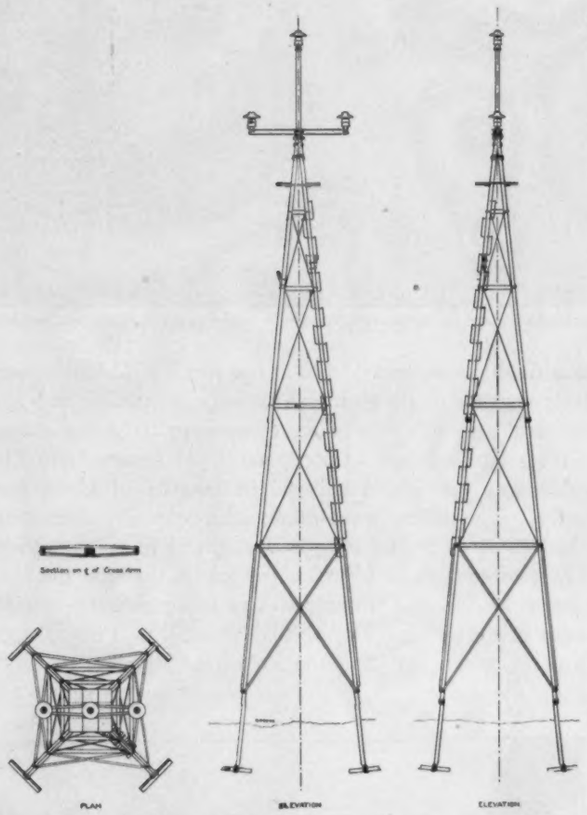


FIGURE 46. THE TRANSMISSION TOWER

PHOTOGRAPH NO. 47. LOADING THE PACK ANIMALS

The towers, photograph 45, are special 40-foot four-post galvanized steel structures weighing about 1,500 pounds, made of 3x3x3-16 in. angles, braced and stayed with smaller angles and rods. Each post terminates in an anchor consisting of a piece of angle iron 30 inches long, secured at right angles. The construction is clearly shown in the drawing of the tower, figure 46.

A 40 foot tower with the 3½ in. extra heavy pipe fixed in position at the apex, was built for testing at the factory of the Aermotor Co. This tower was bolted in its assembled state to the 30 in. wall of a five story brick building; so that its axis was horizontal instead of vertical as normally, a rope sling was attached to the pipe 70 inches above the apex of the tower, and to this a wooden platform was attached. Weighed masses of pig iron were then placed upon this platform and the deflections of pipe and tower noted. When the load amounted to 900 pounds the pipe began to show signs of yielding, the

PHOTOGRAPH NO. 49. ASSEMBLING A TRANSMISSION TOWER

tower, however, was perfectly rigid. When the load was 1234 pounds, the deflection of the pipe from a straight line amounted to about 6 inches. On removing the load a permanent deflection of about 1 inch was found. The load was replaced and increased about 70 pounds at a time. With each increase the pipe took an additional permanent set, and at a load of 1560 pounds, it continued to bend until the load rested on the floor.

The transportation and distribution of the towers was carefully planned and very satisfactorily carried out. The necessary quantities of parts were shipped to the several railway stations which had been selected as centers for the distribution along the line. From the railway stations the towers were hauled in wagons to convenient points on the highway and then were transported piecemeal through the fields on pack animals to the proper places on the transmission line; some of the longest pieces being carried by two burros in tandem. See photographs Nos. 47 and 48.

PHOTOGRAPH NO. 48. TRANSPORTING TOWER PARTS THROUGH THE FIELDS

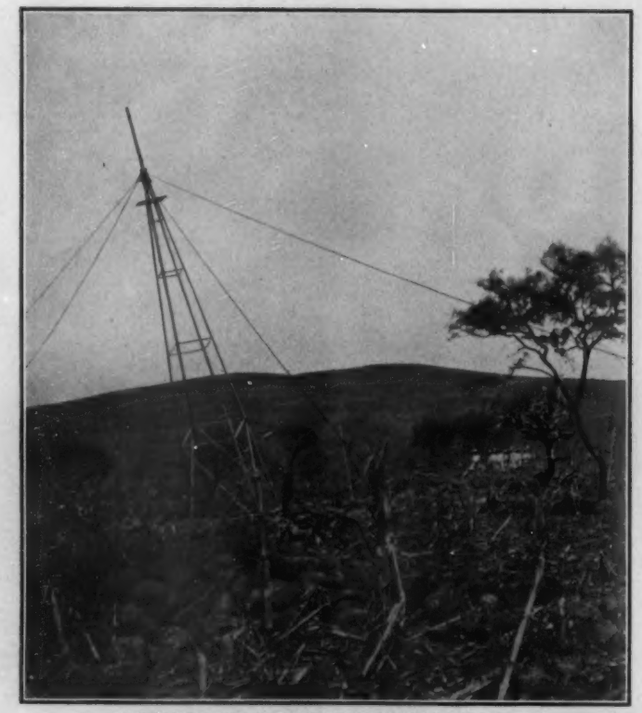
The assembling and erecting of a tower in place required skill and care. A gang of six Mexicans could assemble three towers a day. This was done with the tower lying on the ground, as shown in photograph No. 49. A gang of twelve Mexicans under an American foreman could easily erect twelve towers a day in the manner shown in photographs Nos. 50, 51 and 52.

The all metal construction of the supports for the transmission line was determined upon only after very thorough study and analysis and with a full realization of the fact that the insulators must then be of the most reliable and ample construction. The quality and suitability of the insulators were, therefore, carefully looked after.

The advantages of long spans, with consequent reduction in number of supports and of insulators required, were so obvious that it was at once decided to adopt that type of construction.

After careful study and many calculations and estimates the 40 foot towers spaced twelve to the mile were determined upon. The towers are spaced 440 feet apart, twelve per mile, except near Guanajuato where the nature of the ground necessitated the use of a few sixty foot towers and spans up to 1320 feet in length.

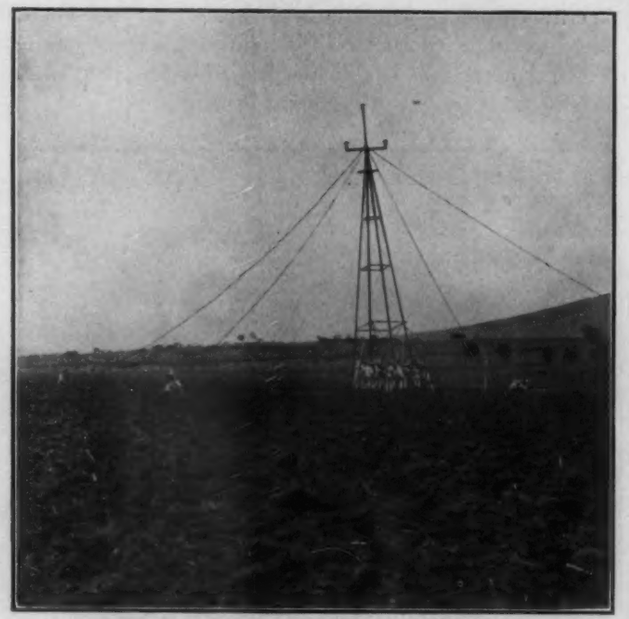
PHOTOGRAPH NO. 50. ERECTING A TRANSMISSION TOWER



PHOTOGRAPH NO. 51. ERECTING A TRANSMISSION TOWER

Two No. 9 B. B. double galvanized iron wires for a telephone circuit are fastened on the transmission towers ten feet below the copper power cables. They are tied to regular glass insulators placed on 12 inch painted oak brackets bolted to tower legs. The telephone wires are transposed one complete revolution every four towers; the power cables are not transposed. High resistance instruments are used, and the telephone service is quite satisfactory.

The climatic conditions for high voltage transmission are usually good and during the dry season when the water is lowest, and when all the losses should be kept at a minimum, the atmospheric conditions are very favorable. Once or twice insulators at the top of the pole have been shattered, possibly by lightning. Photograph No. 53 shows a form of lightning rod that is being put on a number of the most exposed towers.

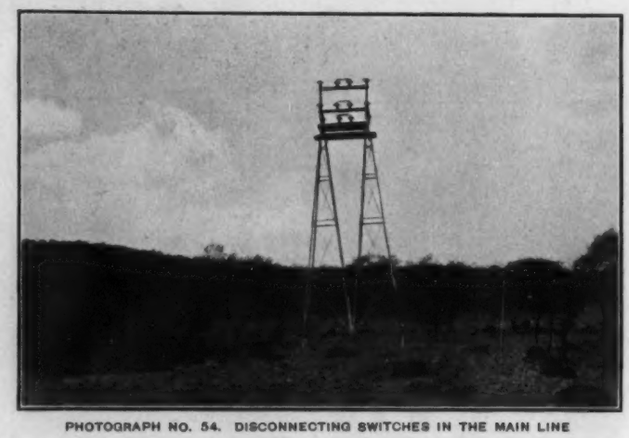


PHOTOGRAPH NO. 52. ERECTING A TRANSMISSION TOWER

The long line of shining galvanized steel towers will catch the eye of the traveler as the train nears Palo Verde on the Guadalajara branch of the Mexican Central Railroad, or on approaching Irapuato on the main line from the north, at which points the transmission line crosses the railroad. It is almost straight, there being only a few slight horizontal angles.

The line is divided into four sections of about twenty-five miles, and is in charge of a superintendent whose headquarters are at the middle storehouse. At each of the three division points there is a first-class storehouse, a set of 60,000 volt disconnecting switches in the main line, photograph No. 54, a line foreman and patrol man both mounted. In the middle of each section there is a second-class storehouse in the care of a mounted patrol man.

At Guanajuato the transmission line cables enter the



PHOTOGRAPH NO. 54. DISCONNECTING SWITCHES IN THE MAIN LINE

sub-station through a set of 60,000 volt disconnecting switches, the same as at the generating station (photograph No. 55).

The Guanajuato sub-station is a handsome stone building with brick trimmings and a flat roof, standing in a beautiful grove of trees. Photographs Nos. 56 and 57. The dimensions of the building are, length, 113 feet, width, 89 feet. There is a central portion two stories high with well proportioned one-story wings on either side. One wing contains an office for the general manager, a drafting room, an accounting room and a reception room. The other wing is fitted up for a repair shop and store room. The central portion contains the transformers. A 10 ton hand operated crane runs over the shop and transformer room; passing through folding iron doors.

The electric current enters the building, passes a set of lightning arresters with disconnecting switches, like those at the generating station, and goes to a bank of oil insu-

lated water cooled transformers where the line potential is reduced to 15,000 volts. These transformers are rated at 970 K. W. each. Their efficiencies as determined by factory test are as follows:

Full load .....98.193%.
Three-fourths load .....97.93%.

From the step-down transformers the cables pass through ducts under the floor to the switchboard, thence to the six 15,000 volt 3-phase distributing circuits, each of which is equipped with lightning arresters, and air break switches with tube fuses.

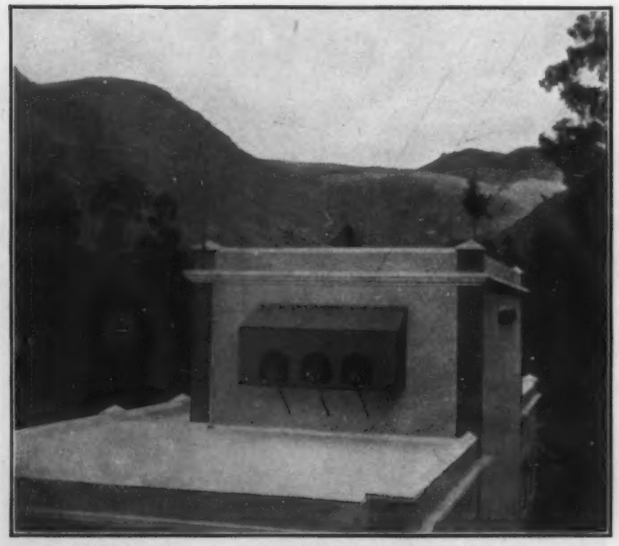
The solid copper wires of the distributing circuits are carried on 5¼ inch brown porcelain insulators, supported on wooden pins in wooden cross-arms on square yellow pine poles, 30 to 35 feet in height, 9 in. x 9 in. at the butt, and 7 in. x 7 in. at the top. The iron telephone wires are carried on the same poles but are frequently transposed. The power wires are not transposed.

At the mines and mills where the electric power is used the potential is reduced in three-phase transformers from 15,000 volts to 460 volts for motor service. The

PHOTOGRAPH NO. 53. THE LIGHTNING ROD THAT IS BEING INSTALLED

PHOTOGRAPH NO. 56. THE GUANAJUATO SUB-STATION FROM IN FRONT

PHOTOGRAPH NO. 57. THE GUANAJUATO SUB-STATION FROM THE SIDE DURING CONSTRUCTION



PHOTOGRAPH NO. 55. THE TRANSMISSION CABLES ENTERING THE GUANAJUATO SUB-STATION

Guanajuato city 2-phase, 2100 volt lighting system is supplied through a bank of 150 K. W. 3-phase to 2-phase transformers with a feeder regulator in each phase.

Photograph No. 58 shows where a branch line leads from the main transmission line to Irapuato, the "Strawberry Station" on the Mexican Central Railway. The Irapuato sub-station (photograph No. 59), is a brick building equipped with 60,000 volt disconnecting switches and lightning arresters and the following oil insulated air cooled transformers:

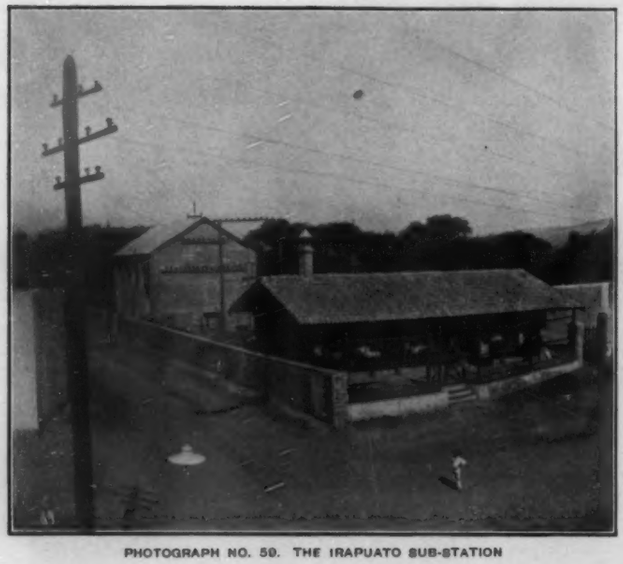
Four 200 K. W. line potential to 15,000 volts.

Four 75 K. W. 15,000 to 460 volts for motor service.

Two 40 K. W. 15,000 to 2200 volts for the city lighting system.

Power is supplied to various small industries throughout the city, including three grist mills, a foundry, a wagon works, a paint factory and various pumps used in irrigating the strawberry fields.

To the ingenuity of the American engineers, backed by American capital, is due this noteworthy development by



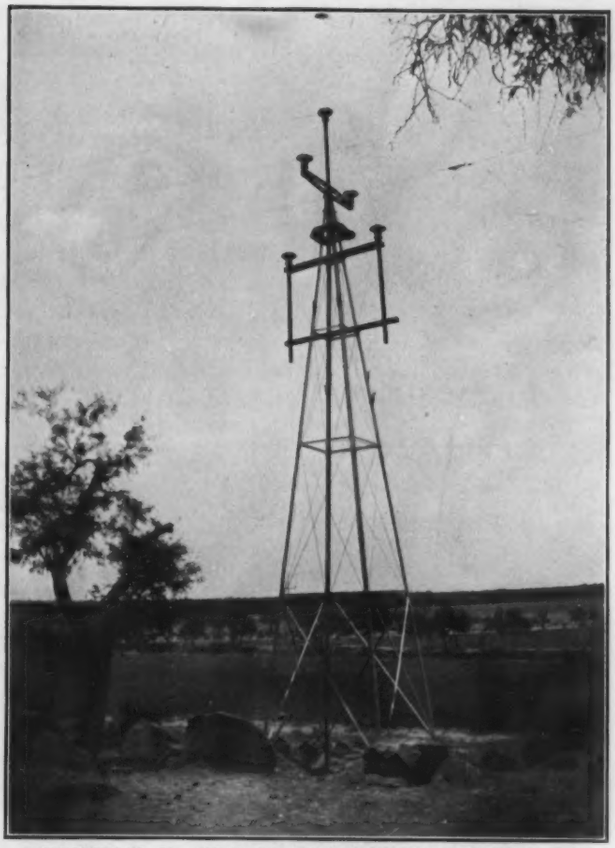
PHOTOGRAPH NO. 59. THE IRAPUATO SUB-STATION

PHOTOGRAPH NO. 62. THE TEAM OF TWENTY-TWO MULES HAULING ONE-HALF OF A GENERATOR ARMATURE

PHOTOGRAPH NO. 60. THE CITY OF GUANAJUATO, MEXICO

PHOTOGRAPH NO. 61. PART OF THE PROCESSION FORMED TO HAUL ONE-HALF OF A GENERATOR ARMATURE THROUGH THE STREETS OF ZAMORA

PHOTOGRAPH NO. 63. UNLOADING PIPE SECTIONS AT ZAMORA



PHOTOGRAPH NO. 58: METHOD OF JOINING THE IRAPUATO BRANCH LINE TO THE MAIN TRANSMISSION LINE

which the energy of the swift and boisterous Duero River has at last been harnessed and after conversion into electricity has been transmitted over the 100 miles of intervening country to revivify the mining and other industries of the picturesque old city of Guanajuato (photograph No. 60), famous for its great mines which are said to have produced, during the past 350 years, about one-fifth of all the silver in the world. Of late years these mines have not been worked to any great extent, largely because of the high cost of power.

There were many interesting, as well as difficult features, connected with the construction work.

The task of hauling to the construction camp was by no means easy, although the distance was not more than ten miles. The way lay through the city of Zamora, thence to the little town of Jacona and thence about six miles along the State highway to the construction camp at the little Indian village of El Platanal, where the power generating station is located.

American mules were purchased and specially designed American wagons were provided in order that adequate means should be at hand for carrying the heavy parts to their places.

The roads through the country are mostly over black adobe soil of indefinite depth and a few rainy days are sufficient to convert such roads into regular quagmires. The haul through Zamora and Jacona was by far the worst part, since the streets had been improved (?) by a pavement of stones of no small diameter, and in spite of the wide tires the wagons would break through the pavement into the underlying mud during the short intervals of time allowed for the animals to rest. Photographs Nos. 61 and 62 show a team of twenty-two mules hauling the lower half of the armature of one of the generators, a load weighing 20,000 pounds. To get this load safely over the city streets required the combined efforts of two American superintendents and ten peons, all directly interested in some way in the moving of the load. Two wagons followed carrying jacks, block and tackle, and tools for making repairs en route, forming in all quite a procession.

The handling and hauling of the pipe sections, weighing from 7,000 to 12,000 pounds each, a total of about 600 tons, was expeditiously completed as shown by photographs Nos. 63, 64 and 65.

It is to the credit of the transportation organization that all of the hauling was done without the loss of or damage to a single piece of apparatus.

The native methods of excavating the canal and the tail race are shown in photographs Nos. 66 and 67.

Carrying out a project of this magnitude in Mexico is made doubly difficult by the dense ignorance and absolute carelessness of the laboring class. The laborers, or peons, are mostly Indians or half breeds, except where they are specially imported. These people wear as little clothing as possible, eat and drink whatever comes to hand, smoke cigarettes incessantly, are always ready to talk or play and are never ready to work.

From time immemorable they have carried things on

PHOTOGRAPH NO. 64: THE GREAT OVAL TAPER SECTION, READY TO START FROM THE RAILWAY STATION AT ZAMORA FOR THE HEAD OF THE PIPE LINE NEAR EL PLATANAL

their backs and it becomes necessary for the American to adapt himself to their ideas in order to get work done. It is exceedingly difficult, if not impossible, to teach them new methods of working. The customary method of handling dirt is by means of baskets or costals (a small piece of burlap), carried on the back.

It is reported that when one contractor attempted to introduce the use of wheelbarrows, the peons preferred to carry the barrow, load and all, on their backs rather than learn how to wheel it on a runway.

The wages paid to the laboring man vary from 40 cents to 60 cents per day, Mexican, if he be unskilled, 75 cents

PHOTOGRAPH NO. 65: SECTIONS OF PIPE PASSING THROUGH THE CITY OF ZAMORA TOWARD EL PLATANAL

to $1.25, if he be a cabo (gang boss), from $2.50 upwards, if he be a skilled artisan, and are unquestionably greater than he knows what to do with. On Saturday night the man whose week's work has brought him $2.40 in Mexican silver is so wealthy that he makes a bee line for some place where he can spend his money with the least exertion. Saturday night is usually spent in drinking the vile intoxicants, which are very cheap, and in gambling, and there is rarely a Sunday in a large construction camp that is not celebrated by some shooting or stabbing affray. Monday has been christened San Lunes (Saint Monday) because the men are entirely missing or medio crudo (half drunk), and trying to taper off. In addition to Sundays and Mondays there are in each month a few church holidays upon which no good Mexican works.

The men bring their wives and families into the camp and set up housekeeping in a one roomed shack, easily constructed in half a day, of boulders, and thatched with weeds. Packing boxes were good enough for some, and one family squatted in a short spare length of steel pipe 69 inches in diameter. Nature is kind to these people, furnishing warmth and food such as it is. The only incentives to work are curiosity and a desire to obtain the means with which to get drink and to gamble.

PHOTOGRAPH NO. 66: THE NATIVE METHOD OF EXCAVATING THE CANAL

PHOTOGRAPH NO. 67: THE NATIVE METHOD OF EXCAVATING THE TAIL RACE CANAL

The short time in which this project was executed is most remarkable and is characteristic of the management. The preliminary examination was made in March and April, 1902, construction was begun in the fall of the same year, and in October, 1903, the plant was put into regular operation.

This, undoubtedly, establishes a record in Mexico for rapid and efficient execution of construction work of a technical character and of considerable magnitude, especially in view of the fact that the work was completed within the estimates of cost.

Gas and Power Engineering Development in Monterey County, Cal.

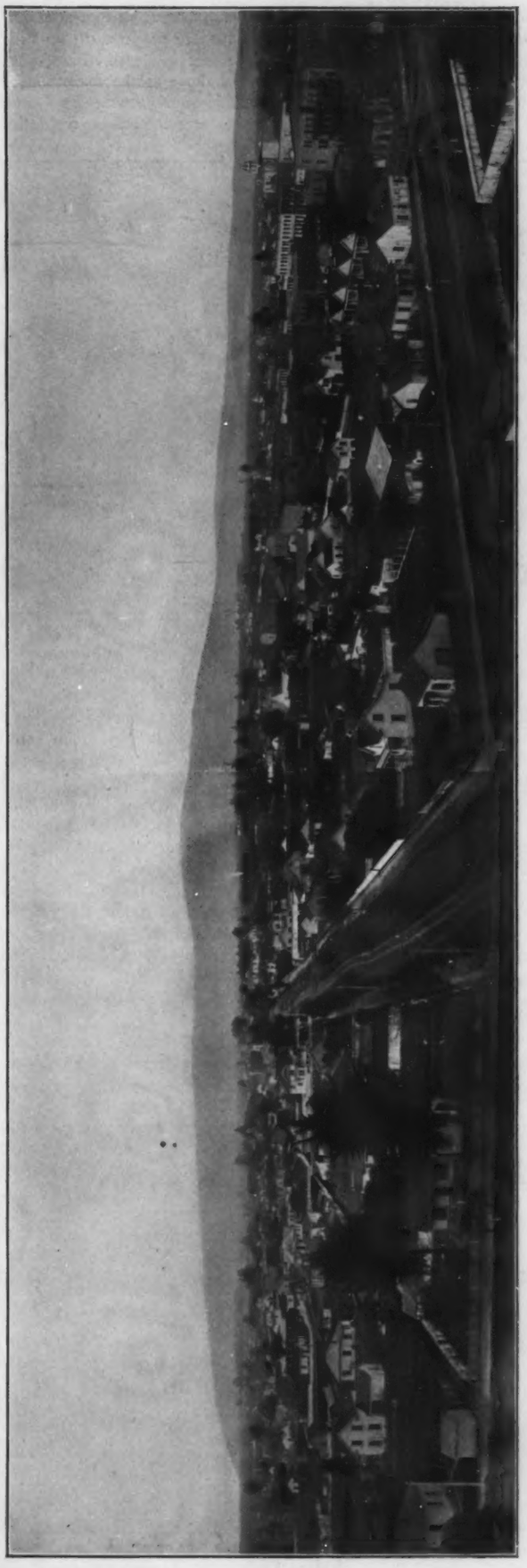
BY GEO. P. LOW.

THIS is a narration of the upbuilding, growth, development, and engineering features of the Salinas and Monterey properties of The Monterey County Gas and Electric Company, of Monterey, California:—

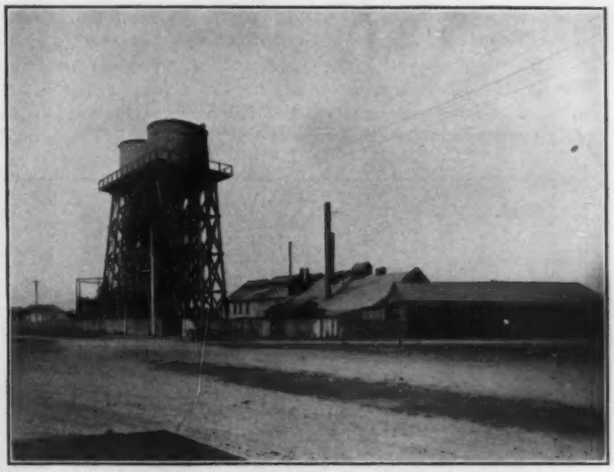
The Monterey County Gas and Electric Company is the direct outgrowth of the consolidation of the Monterey Gas and Electric Company, which was incorporated in April, 1902, and of the Salinas Water, Light and Power Company, which was incorporated in the latter part of 1901,—this consolidation being effected on January 1st of the present year and being made necessary by the growth of the two local companies named. On the other hand the Salinas Water, Light and Power Company was the direct successor to the business and properties of the Salinas City Light and Water Company, while the Monterey Gas and Electric Company succeeded to the business of the Monterey Electric Light and Development Company.

THE WATER AND STEAM-ELECTRIC PLANT AT SALINAS.

Salinas, the county-seat of Monterey County, is situated on the coast line of the Southern Pacific Railroad, 118 miles south of San Francisco and about twenty miles from Monterey. It is a compactly built town of about 4,500 inhabitants and is situated at the lower end of the rich and fertile Salinas Valley, wherein is located the Spreckels beet sugar factory. This,



THE CITY OF SALINAS, MONTEREY COUNTY, CALIFORNIA



A VIEW OF THE WATER, GAS, AND ELECTRIC WORKS AT SALINAS

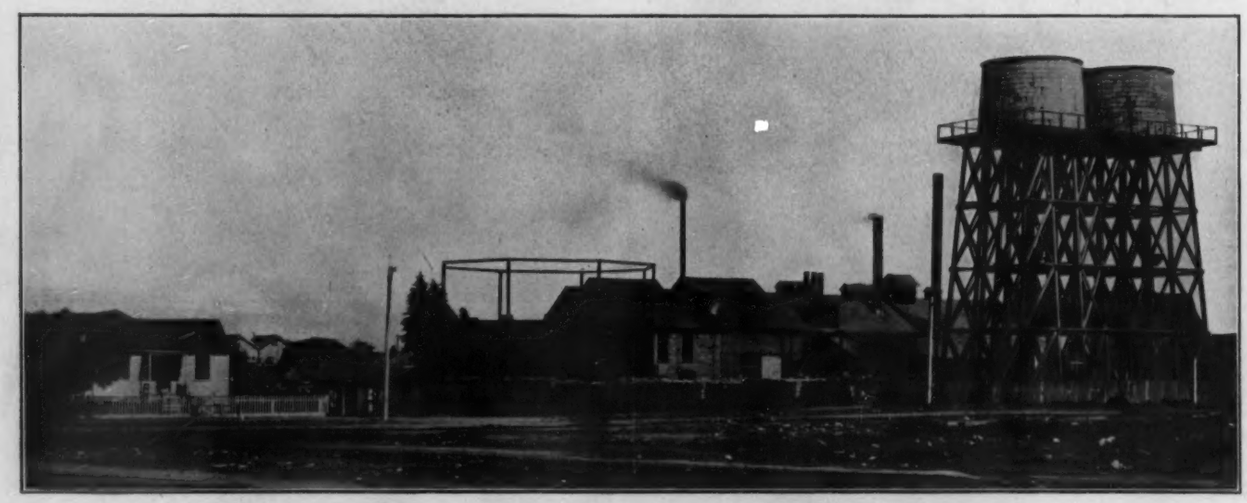
with its capacity of three thousand tons of beets daily, is the largest beet sugar factory in the world, and it distributes annually close to two million dollars among the farmers and laborers of that vicinity for beets and labor.

Prior to their acquisition by the present owners the gas, electric, and water service of the city were operated by the Salinas City Light and Water Company, to which is to be accredited the inception and execution of a concentration of the local quasi-public commodities into a single plant along the lines of the greatest possible economy in operation. In the spring of 1902 the water works plant consisted of four wells, three pumps, four tanks, and 11.3 miles of distributing mains; its gas works consisted of a coal gas plant with two holders, having capacities of fifteen thousand and thirty thousand cubic feet respectively and three and one-half miles street mains; and its steam-driven electric lighting plant contained about 175 kilowatts in alternating current electric apparatus, the services from which covered the greater portion of the town. The works for these three classes of service were located on a tract of land practically one acre in size that is situated comparatively at a short distance south of the Southern Pacific depot.

Steam for the operation of these works was generated in a battery of two boilers, both of which are of the return tubular type, their dimensions being 54 inches by 16 feet, and 72 inches by 18 feet respectively. The pumping equipment consisted of a 25-horsepower White & Middeton gas engine, which was connected by belting with a Stilwell-Bierce & Smith-Vaile triplex power pump, having 10-inch cylinders, a 12-inch stroke and a 10-inch suction, with a 7-inch double discharge. This pump has a

SALINAS OFFICE OF THE MONTEREY COUNTY GAS AND ELECTRIC COMPANY

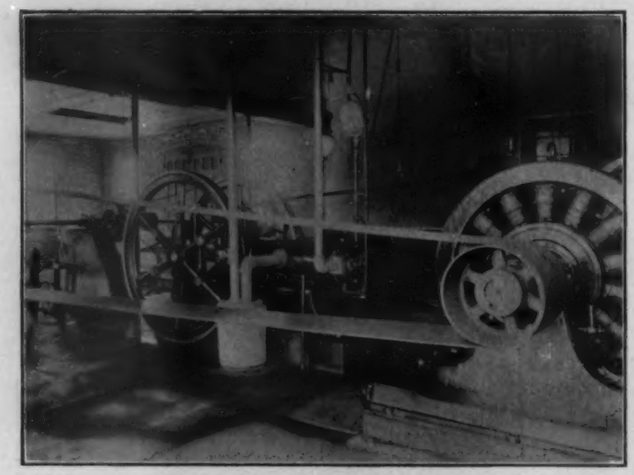
capacity of about 1,000 gallons per minute. A Lane and Bodley simple Columbian Corliss engine of 42-inch bore and 16-inch stroke occupied space near the center wall of the engine-room and from it was driven a long countershaft so arranged that in addition to driving the dynamo it could be used to operate the triplex pump in case of disability of the gas engine. The electric



A GENERAL VIEW OF THE WATER GAS AND ELECTRIC WORKS AT SALINAS

plant consisted of a 50-kilowatt National and a 125-kilowatt General Electric alternators, each delivering single phase current at 1,040 volts, these, of course, being supplemented by the usual auxiliary equipments, among which was a 1½-kilowatt General Electric type I. B. exciter.

The gas plant, which is housed under the same roof, originally

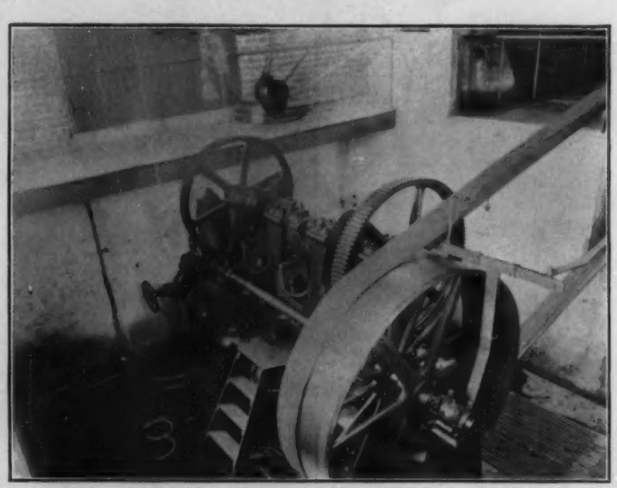


A 25 H. P. WHITE & MIDDLETON GAS ENGINE DRIVES THE PUMPS FOR THE SALINAS CITY WATER WORKS

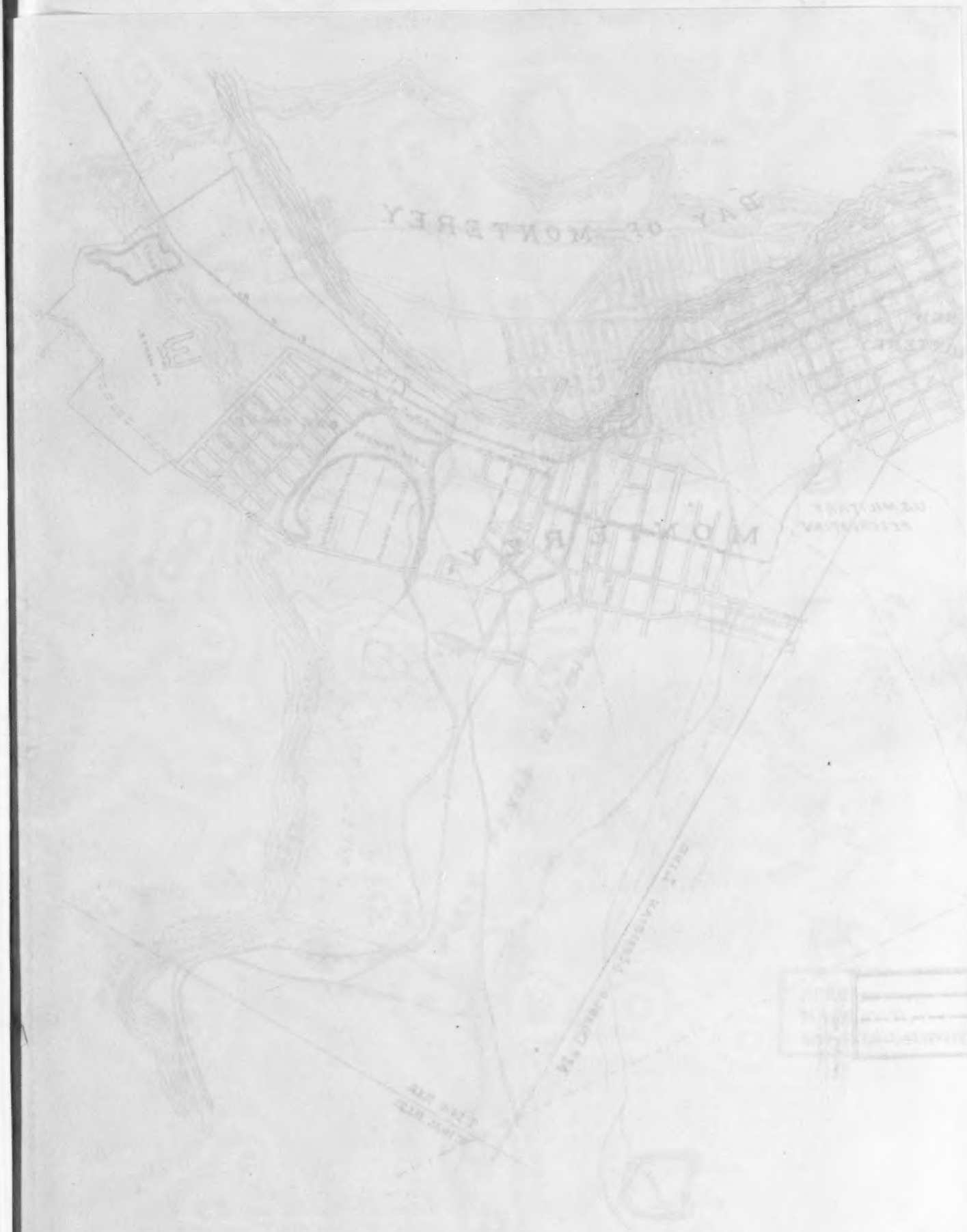
consisted of two coal gas benches of threes, with purifiers, scrubbers, condensers, etc., and having a capacity of twenty-four thousand cubic feet per day. This plant was entirely remodeled under the direction of E. C. Jones in 1889, but since the property has come into the present owners the manufacture of coal gas has been discontinued in favor of water gas made from crude oil, as is fully detailed hereafter.

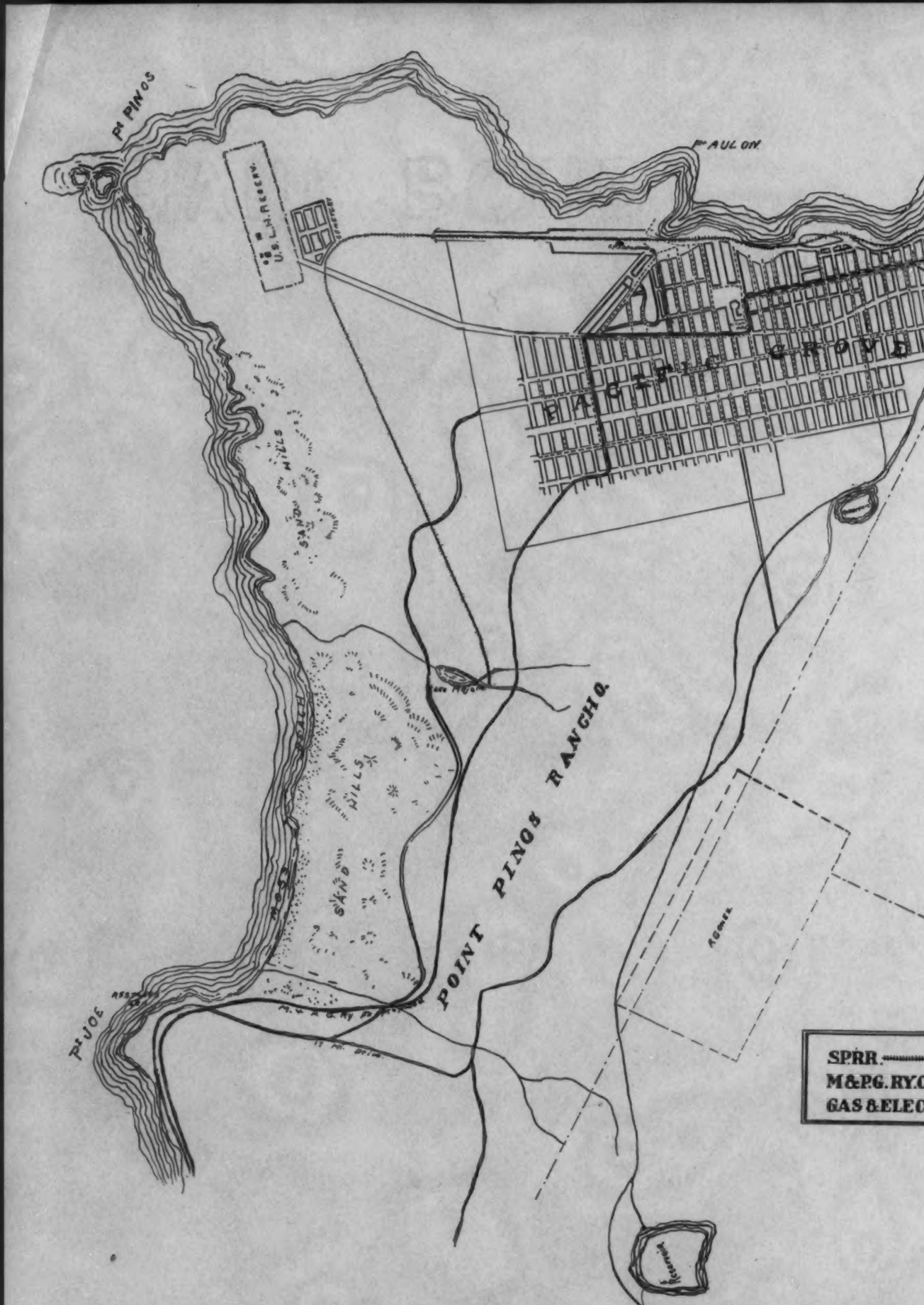
An interesting innovation that was installed by the Salinas Water, Light and Power Company (which succeeded the Salinas City Light and Water Company) as an auxiliary to its water works consisted in the erection of two 50,000-gallon tanks at opposite corners of the town, in addition to the two tanks of the same capacity at the main pumping station. One of these auxiliary tanks is located about 2,000 feet north and the other about 4,000 feet west of the main pumping station. A 14-foot aermotor was erected at each of these tanks for the purpose of pumping water from a 6-inch bored well 160 feet in depth, these tanks being placed at the same elevation as those at the main station and connected direct to the water mains of the town. Two similar windmills and tanks were to have been erected on respective lots that had been purchased for the purpose by the former owners, but owing to the sale of the property the plan was not carried out. That it was an excellent arrangement is not to be doubted, but it was found to be particularly applicable to a town where the water pressure is light and the mains are of moderate size, for obviously through this system the water storage is distributed equally about the four sides of the town, giving equal pressure to all parts. Experience has proven that the windmills have a capacity for pumping about 1,800 gallons of water per hour with the lift of 85 feet and with a wind velocity of 16 miles per hour. The wind is quite constant from the ocean, blowing from about 10 o'clock in the morning until about 9 o'clock at night during the spring and summer and fall months, hence for a period of eight months in the year it is probably fair to reckon on an average delivery of from 30,000 to 40,000 gallons delivered into the tanks per day by the two windmills, when kept in good order. This is approximately 7 per cent of the total consumption of water used by the town.

The performance of 25 horsepower gas engine that operates the triplex pump for supplying the city water works of Salinas calls for particular comment in view of the unusually heavy duty

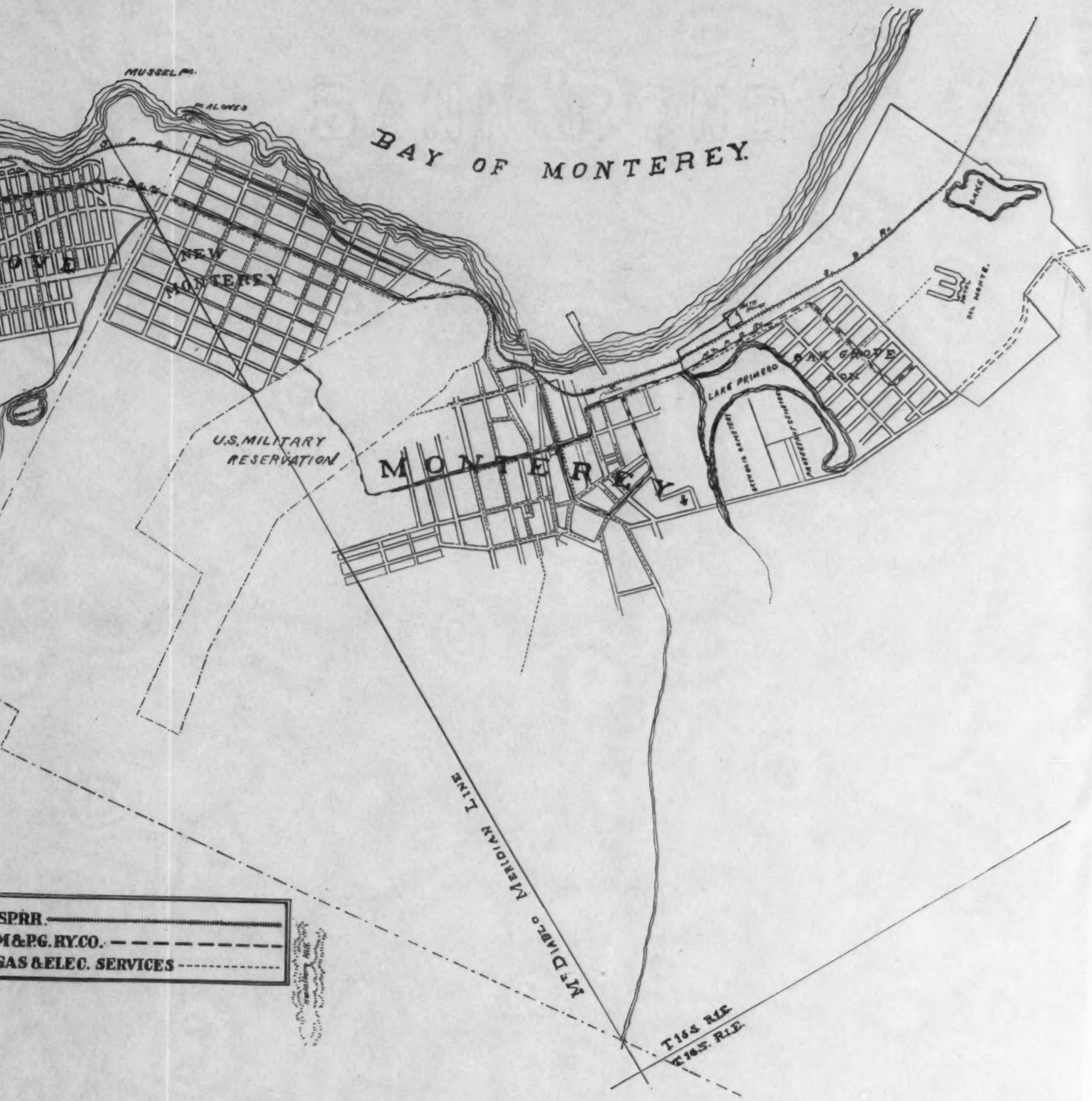


THIS PUMPS THE WATER FOR THE CITY OF SALINAS

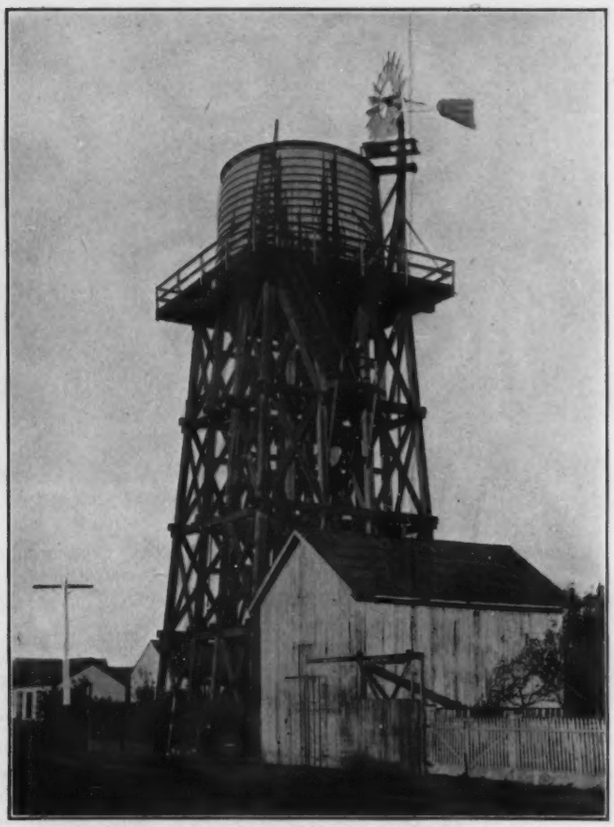




MAP OF THAT PORTION OF THE BAY OF MONTEREY EMBRACING HOTEL DEL MONTE, OAK GROVE



OAK GROVE, MONTEREY, FORT ORD, NEW MONTEREY AND PACIFIC GROVE, SHOWING STREET RAILWAY AND THE GAS AND ELECTRIC LINES



WINDMILLS SUPPLEMENT THE CITY'S WATER SUPPLY AT SALINAS

that it has been called upon to perform. As the result of its aggressive business methods, the company has long since loaded its electric plant to the fullest possible capacity, in view of which it has not been possible to call upon the steam engine for any power for pumping purposes. In other words, the gas engine has been forced to carry the entire load without assistance from the steam engine, and this it has done with remarkable satisfaction. In May last the gas engine averaged a service of 16 hours and 8 minutes per day; in June the average was 18 hours and 34 minutes per day; in July, 18 hours and 43 minutes, and from August 1st to August 17th, the daily average was 19 hours and 21 minutes. The engine pumps against a head of 121 feet, and for this duty it averages a consumption of 400 cubic feet of 650 British thermal unit gas per hour.

To relieve this excessive service on the part of both pump and gas engine, there has been installed a 50-horsepower Byron Jackson centrifugal pump that is to be driven from the main countershaft which, by the way, will be in operation twenty-four hours a day hereafter owing to the fact that day power service is to be maintained.

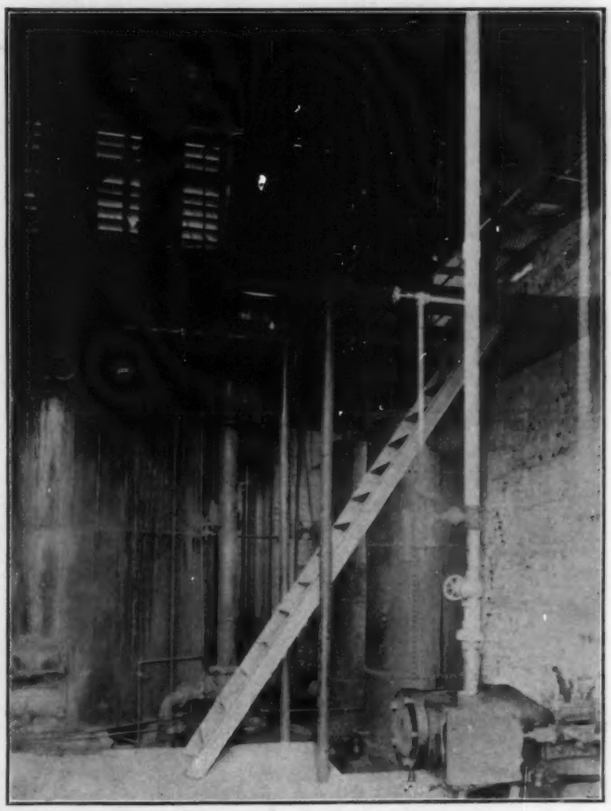
But comparatively little change, aside from the installation of a new 7,500-foot-per-hour Lowe crude oil gas setting, has been made in the internal arrangement of the Salinas plant since the present owners took possession of the property, for a careful diagnosis of the situation at the outset led them to believe that the first exertions toward the betterment of the property must be devoted to increasing the load factor of the electric station and improving the service of the gas and water ends of the business by piping every street and avenue of the city. This was done, with the result that while two years ago there were but eleven miles of water mains, for instance, in service, there are at present over nineteen miles of such mains in use, and to which close to 1,800 water consumers are connected. In the same period of time the length of gas mains in service has been increased from practically three miles to about twenty-four miles, and it is interesting to note that while the first gas range was installed in April, 1902, on August 1, 1904, there had been installed 237 gas ranges together with thirty hot plates and fifty gas water heaters. In the meantime the gas rates have been voluntarily reduced from $4 per thousand to $1.50 per thousand, and in this reduction the company has experienced the great satisfaction of realizing that the gas output is at least in inverse proportion to the rate charged.

To particularize: with the exception that the National generator above referred to has been placed out of commission, that a 25-light series alternating current 6.6 ampere arc transformer of General Electric build has been installed, and that the entire electric load is carried on the 125-kilowatt General Electric generator already referred to, no material change has been made in the steam-electric station at Salinas from the arrangement adopted by the former owners. The time is near at hand, however, when additional machinry of both steam and electric varieties must be installed, as is evident from the statement that the output of the machine aggregates 2,450 16-candlepower lights nightly, and that the "waiting list" of the station for incandescent service already aggregates practically 1,000 lights.

Thus far all electrical distribution is on the single phase system, for the very sufficient reason that only single phase service is available. As far as it is practicable to do so, secondary services are grouped from transformers of large capacity, and in the business section of the town three-wire secondary distribution is used. The pole lines aggregate a length of thirty miles, the poles being of square cedar thirty feet in length and the circuits consisting of Nos. 4, 6, 8 and 10 copper wire insulated with weather-proof covering.

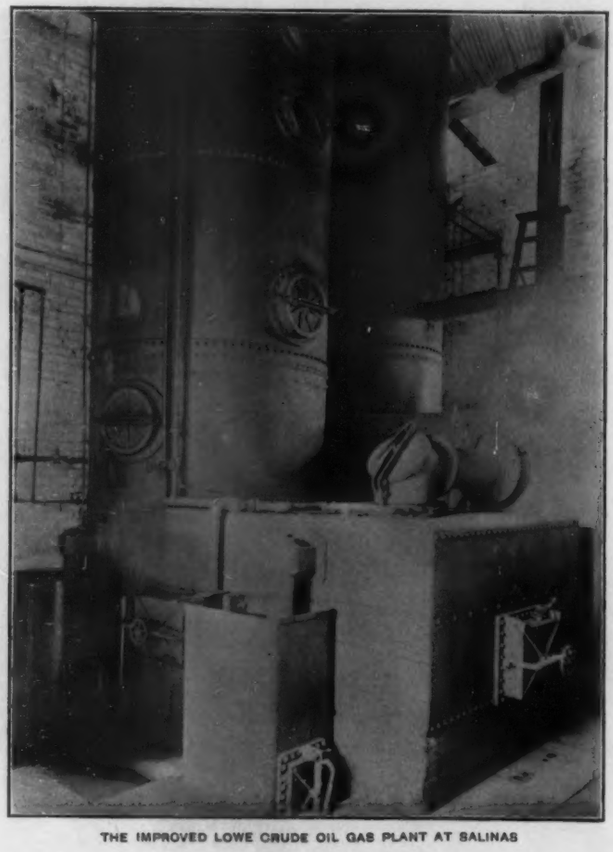
THE SALINAS GAS WORKS.

In considering the gas plants of the Monterey County Gas and Electric Company, which are located in Salinas and Monterey respectively, one is struck by several interesting situations, one of the most significant of which lies in the living evidence of rapid development that is taking place in manufacture of artificial gas. The older of the two plants, that of Salinas, dates from 1873, when there was installed a coal gas plant consisting of two



THE OLD HOYT SETTING AT SALINAS

benches of threes, together with the necessary condensers and purifiers and a holder having a capacity of 15,000 feet. In 1889 this plant was entirely remodeled and rebuilt as a modern coal gas plant upon designs drawn by Mr. E. C. Jones, then chief gas engineer of the San Francisco Gas and Electric Company. The remarkably increased efficiency of oil gas apparatus over the best coal gas plant resulted in the determination on the part of the Salinas Water Light and Power Company to install an oil gas system, with a result that a Hoyt plant was erected. In this system, which is but little known on the Pacific Coast,—in fact the only Hoyt plant now in operation is at San Luis Obispo, California,—the generator consists of a three-sided shell of malleable iron that measures eight feet to the side and which stands about eighteen feet in height. Within this shell are three circular openings, each three feet in diameter, and four other circular openings, each fourteen inches in diameter, the latter being used as steam superheaters in that they contained steam coils. These seven openings were run vertically, that is axially, to the main outer shell, through the brick work which filled it. The three-foot openings constituting the generator were separately fired during the period of blow, each being provided with an independent stack. During the period of make, however, the three generators were connected in series, superheated steam and oil being introduced at the top of No. 1 generator. Generator No. 1 was the hottest of the three, and its products were conveyed to the bottom of generator No. 2; from the top of the latter they, together with the products of No. 2, were carried through an 8-inch opening in the hot brick work to the top of generator No.3, and from the bottom of the latter the products of all three generators were conveyed through an 8-inch pipe to the "hydraulic," as the scrubber was then called. A tar well intervened between the "hydraulic" and the condenser, and after leaving the latter it passed through the purifiers and on to the holder. This apparatus was never regarded as satisfactory, as its efficiency did not exceed seventeen gallons of 14° B. crude oil per thousand feet of gas made, but despite this it is believed that the main difficulty rested in inadequate



THE IMPROVED LOWE CRUDE OIL GAS PLANT AT SALINAS

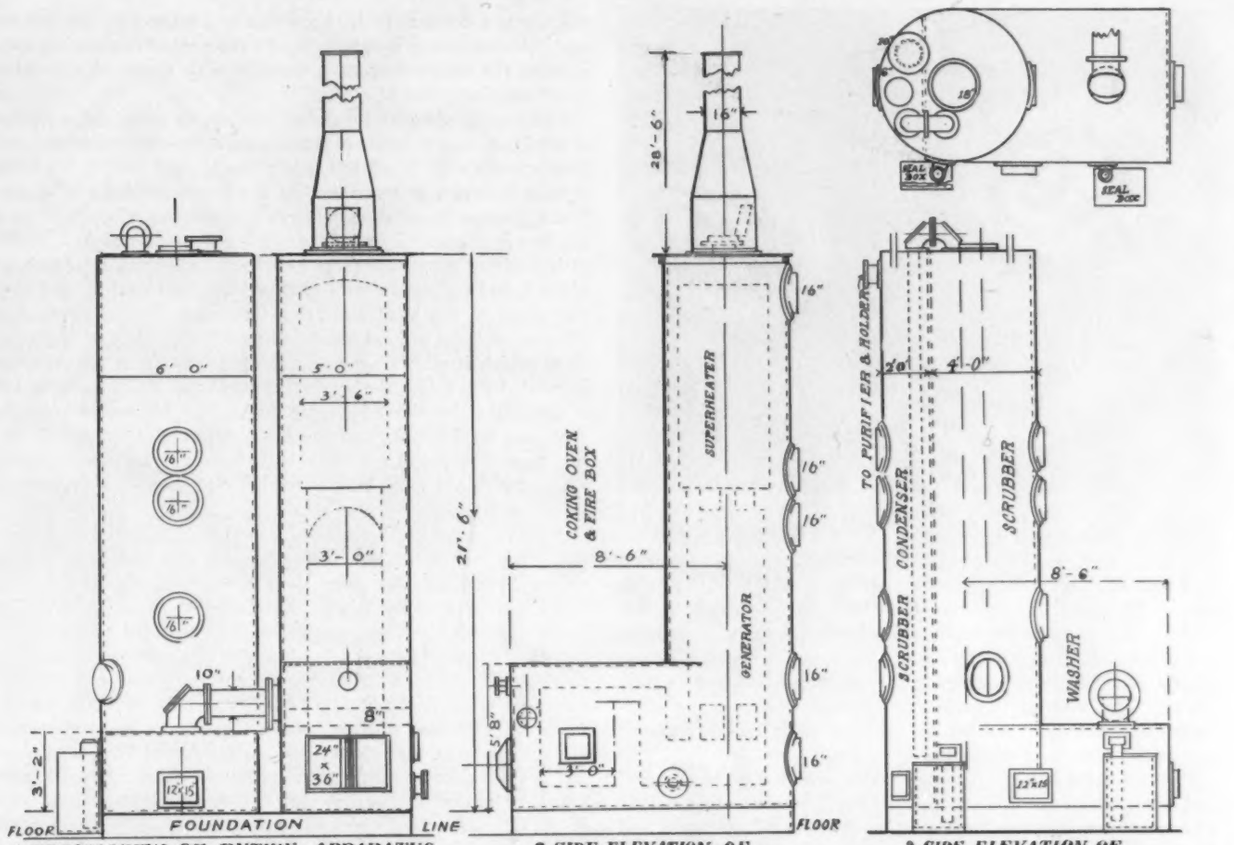
ARRANGEMENT OF PIPING AND VALVES UNDER THE PURIFYING ROOM AT THE SALINAS GAS WORKS

scrubber and condenser capacity rather than in any insurmountable deficiency in the generator proper. The Hoyt set continued in operation until May of the present year, when the 7,500-foot Lowe crude oil water gas apparatus, about to be described, was installed. By the expenditure of a small amount the Hoyt apparatus can be made into a modern setting. When this is accomplished it will be used as an auxiliary.

The striking feature of the latest type set of Lowe crude oil water gas apparatus as brought out by the California Light and Fuel Company, and as installed at Salinas, centers in its extreme compactness, for it consists of but two shells, the first of which consists of the generator and steam-superheater combined with a coking oven, while the second of which contains the combined washer, scrubber and scrubber-condenser. The superheater is, of course, mounted above the generator and is heated direct by the blast that is applied to the latter. Before proceeding to the operating features, however, it is well to consider the details of construction of the several pieces of apparatus used:

The combined gas generator and steam superheater has a diameter of sixty inches by height of twenty-one feet six inches. It is made of a shell of $^{5}/_{16}$-inch steel and fitted with two heads; the top head, which is removable, consists of $^{3}/_{16}$-inch flat steel that is bolted to an outside angle iron ring through a joint made perfectly tight by means of a special gas cement. The bottom head is of quarter-inch flat flanged steel. From the center of the generator on the floor line extends a fire box that is sixty inches wide, sixty-eight inches high and eight feet six inches long. It is constructed of the same material as that used in building the generator, and while its top and bottom heads are flat and are not specially strengthened, its sides, which are also flat, are provided with eight strengthening braces. As already stated, the superheater surmounts the generator, and above the superheater is a 12-inch stack valve fully fitted with weights and an operating lever that extends down the side of the generator shell to within four feet of the floor. Above all rises a steel stack sixteen inches in diameter and twenty-eight feet six inches in height. It is made of Nos. 12 and 14 stack steel, and is fitted with bonnet and strengthening bands and supports for fastening it to the shell, as well as with suitable guy bands and ropes.

The by-product resulting from the manufacture of crude oil water gas is lamp black, as all know, and in order to render this marketable, a coking process has been devised wherein the lampblack is converted to coke through continuous baking for several hours at high temperature. In the Salinas apparatus, the fire box is made extra large in order to contain the coking oven into which is placed an iron box filled with lampblack, and although it was anticipated when the plant was installed that the service which the gas apparatus was called upon to perform would be sufficiently continuous to enable coke to be made, it has been found by experience that this surmise was not correct and that

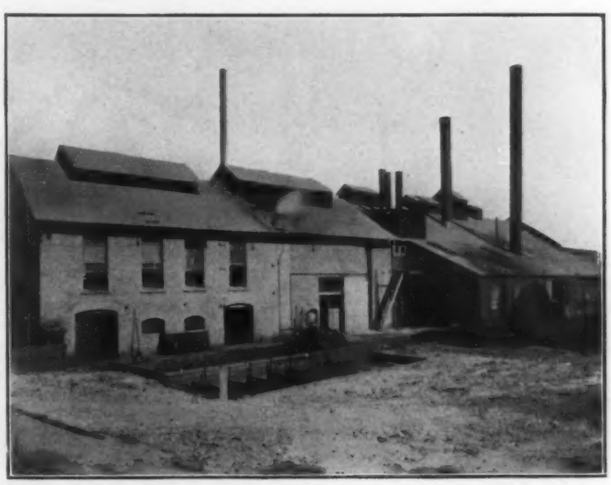


SECTIONAL ELEVATION OF THE IMPROVED LOWE CRUDE OIL GAS PLANT AT SALINAS

the practically continuous operation of the plant is necessary before coke can be made. As a result the coking adjunct is out of commission and in all probability will remain so until the output of the works is sufficiently great to enable the plant to be run continuously. Nevertheless the coke that it has produced experimentally is of excellent quality and is far superior to the best coal gas coke in every particular.

The exterior fittings of the combined steam superheater and generator consist of a coke door twenty-four by thirty-six inches in size that is placed in front of the fire box in the rectangular position shown in the drawing. Above this coke door, which is held in position by means of quick opening bolts, appears the 1¼-inch blast injector of the special vaporizing pattern of the California Light and Fuel Company. An eight-inch blast pipe, with a 10-½-inch blast outlet, delivering air from a No. 4 Sturtevant monogram blower, is carried inside the extension fire box and by means of it oil is distributed in fan-like form and burned as a blast. The air blast is fitted with an eight-inch sliding stem and lever valve. In all places where the shell is tapped for screw pipe connections it is reinforced by steel plates riveted thereto, and all doors, in addition to being interchangeable, are of a special self-sealing and quick-opening patterns. The gas making oil burners are two in number, each 1¼ inches in diameter, and are fitted with all necessary operating valves, together with special quick-acting connecting unions to allow of rapid removal for cleaning in case of stoppage. Two sight holes are used and these are respectively fitted with 1¼-inch and one-inch air space sight cocks. The oil for gasmaking purposes is introduced into the top of the generator beneath the arch of fire brick (which is indicated in the diagram by dotted lines appearing half way up the shell) by means of vaporizing oil injectors that are, as stated, 1¼ inches in diameter.

The gas generator compartment of the shell is lined to a thickness of twelve inches with Laclede fire brick, but the thickness of this lining is reduced to nine inches in the steam superheater compartment. The bottom linings of these compartments are twelve and nine inches in thickness respectively, the tops are nine inches thick and are supported on an arch that is sprung to a fifty-four-inch radius. These linings are composed of specially shaped extra refractory fire brick and red brick blocks that are laid with close grouted and rubbed fire clay joints. The brick work of the fire box conforms to that used in the generator. All square or oblong openings have a flat arch of special blocks fitted on the keystone principle in conformity with the diameter of the shell, while the inside surfaces of the fire brick linings are laid clean, flush and plumb and so as to give a clear interior space of



SALINAS GAS WORKS, SHOWING THE LAMPBLACK SEPARATOR

A CORNER IN THE ENGINE ROOM OF THE SALINAS PLANT

thirty-six inches in diameter in the generator and forty-two inches in the superheater. Finally, the walls of the fire brick lining were given a finishing consisting of a double wash coating of vitrifying compound. The interior fillings of both compartments of this shell consist of extra refractory shapes of brick work, placed one above the other, and its two compartments are separated by a special fire brick arch supporting the brick which fills the superheater. This arch gives perfect independence between the generator and superheater, so that the brick of either may be removed and replaced without disturbing the other.

The gas outlet branch of the generator, which centers four feet and three inches above the floor line, has a diameter that is four inches greater than the remaining connections of the shell, and it is lined to a depth of two inches by means of a protecting thimble of fire brick that extends well into the lining of the generator. A ten-inch pipe four feet in length to the center of the elbow affords the connection between the generator and the washer, and this connection is equipped with the necessary cleaning openings of the self-sealing type, together with doors of a standard quick-opening pattern.

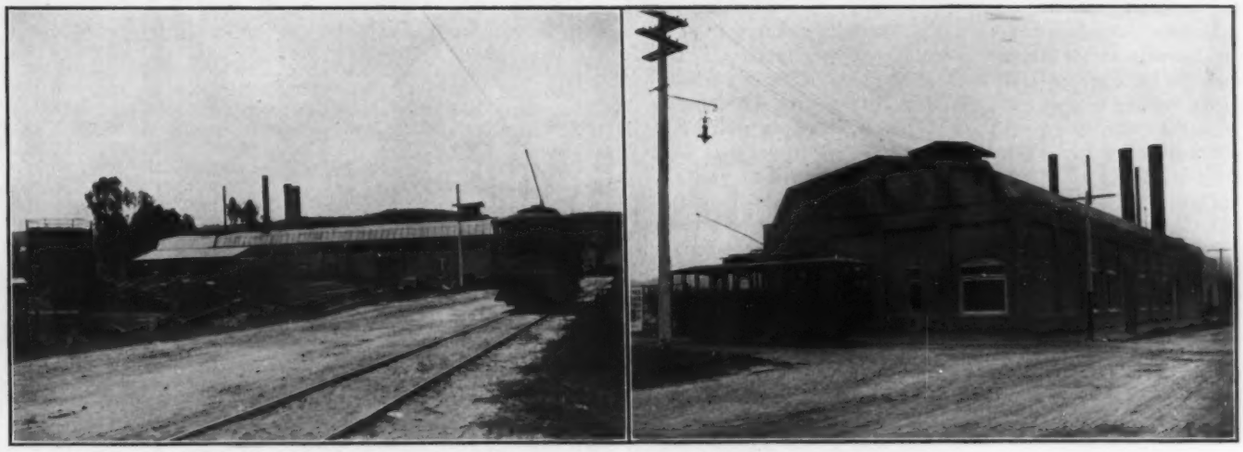
The second piece of apparatus consists, as stated, of a washer, a scrubber, and a scrubber-condenser, ordinarily called the condenser, which are combined into a single shell with a lower extension that closely resembles the fire box extension of the combined generator and superheater. The shell of this apparatus is six feet in diameter by a height of twenty-one feet and six inches. It is made of three-sixteenths-inch shell steel, flanged and strongly riveted, and its bottom is of quarter-inch shell steel flanged to fit the shape of the shell and riveted thereto. The elevation plan gives as well the ground plan of this particular piece of apparatus, from which it will be seen that the gas inlet from the generator is carried down into the washer by means of a pipe opening into a thirty-inch by thirty-inch dip seal. The washer is separated from the scrubber through the intervention of a strongly braced water-tight bulkhead and the washer is provided with an exterior seal through which the bulk of lampblack formed is discharged by means of a trough into the lampblack separator.

A well-stiffened and tightly caulked diaphragm of sheet steel extends from the top head of the shell to the bottom head so as to divide the scrubber formed by the front side of the shell, which occupies two-thirds of its diameter, from the scrubber-condenser which occupies the remaining one-third of its vertical space. The gas is conveyed from the scrubber to the scrubber condenser through two six-inch ells, the condenser end of which continues down to the bottom of the condenser, where it forms a seal. As is the case with the combined generator and superheater, all taps for screw pipe connections are reinforced by riveted plates and besides circular manholes with finished faces, are used in the positions located on the drawing. There are eight of these manholes, all told, each of which has a diameter of sixteen inches, and in addition there are two twelve by fifteen tar doors. The gas is taken from the scrubber through a six-inch flanged outlet, located near the top of the condenser as shown, and from this outlet

THE WATER FRONT OF MONTEREY, WITH OAK GROVE IN THE DISTANCE

it is conveyed through the scrubber and condenser of the old Hoyt gas plant (which have been impressed to the service as additional condensers) whence it is taken to the purifyers after the usual manner.

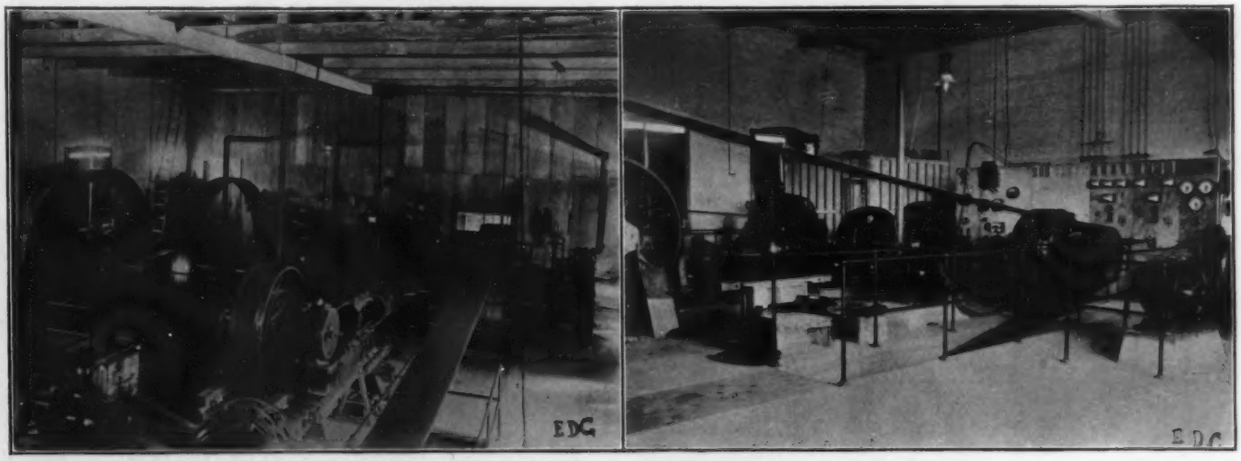
Within this second shell are riveted three angle iron rings upon which are placed trays for supporting the scrubbing or condensing materials. When first installed these materials consisted of broken brick taken from a wrecked building, but the lime and plaster from them soon settled in the bottom of the shell, closing the



TWO VIEWS OF THE MAIN POWER HOUSE, MONTEREY

seals and causing a shut down. As a result of this experience, the broken brick was removed and now the three trays are filled with stove wood, laid crosswise, so as to form a baffling checker work to the spraying devices that continually flood the shell in both compartments. At the outset, too, water for the operation of both scrubber and condenser were supplied from a two-inch main leading from the city water works, but now this source of water supply has been augmented by the addition of a second two-inch pipe that enters both compartments at the top and which is supplied with water taken from the final compartment of the lampblack separator and pumped by means of a small steam-driven eight-inch centrifugal pump. The water spraying devices that enter the scrubber and condenser portions through the top of the shell are, of course, in continuous operation, for experience has proven that crude oil gas cannot be scrubbed too thoroughly. This shell contains two steel plate seal boxes that are both thirty-six inches deep and twenty-four inches long, but one of them—that leading from the scrubber—has a width of twelve inches, while that connected with the washer is eighteen inches wide.

The blower is driven from a simple Jewel engine placed in the adjoining room containing the old Hoyt setting. This engine has a stroke of six inches by a cylinder bore of four and one-half inches and the blower is connected to the generator through a twelve-inch pipe of No. 22 galvanized iron, the seams of which are riveted and soldered. This blast pipe contains a safety valve consisting of a plate that is spring-bolted to the outer sweep of the elbow leading to the fire box. The necessity for this is found in the fact that frequently during the period of make, gas will escape from a generator back into the blast pipe through leaks in the blast valve. As a result, explosions of greater or less violence occur in the blast pipe when the valve is open at the beginning of the blow, and in order to rid the blast of any gas that might accumulate within it, this safety valve is provided. More than this, it is blocked open for a brief time after the blower has been started and before the valve is opened.



TWO INTERIOR VIEWS OF THE ELECTRIC STATION AT MONTEREY

This description of the apparatus used, together with the drawings which illustrate it, convey an adequate conception of the structural details of the latest form of setting used by the California Gas and Fuel Company in building its Lowe crude oil water gas apparatus, and it is fortunate for the sake of clearness in explaining the modus operandi of the plant that it is so compactly arranged. The making of water gas is accomplished in two periods: the first period, which is known as the period of blow, consists of bringing the brick work of the gas generator

and superheater up to a high temperature by means of an adaption of the principle of the blast furnace. In the second period, wherein gas is made and which is termed the period of make, superheated steam is taken from the superheater and delivered direct to the generator, which it reaches in the form of blue or uncarburetted water gas. Into the top of the generator is sprayed vaporized oil and steam which, following the course of the superheated steam, are also decomposed, forming more water gas and at the same time enriching the gas to the required candle power.

Thus far the product is merely a raw, unwashed, and impure gas, and as fast as it is made it is taken to the washer in which it bubbles through water, and in so doing is cleansed from the greater part of its tar and lampblack. Continuing on, it rises through the tortuous interstices of the scrubber, down which a heavy volume of water is constantly flowing. As stated heretofore, the stove wood with which the scrubber, as well as the scrubber condenser, is filled, breaks up the water and thus facilitates the further clarifying of the gas, relieving it of nearly all the lampblack and much of the tar that remains. As the gas enters the scrubber from the washer it is forced under an archway of steel, the under surface of which consists of inverted serrated projections to aid in breaking up and diverting the gas throughout the scrubber. The condenser is identical with the scrubber in its principal of operation, with the sole exception that the gas which reaches it is cooler and that, furthermore, in traversing the condenser the gas is forced through at a higher rate of speed. Each piece of apparatus is separated from its neighbor by water seals, and, in fact, the bottom of the entire shell embracing the washer, scrubber and condenser is kept flooded with a constant and abundant circulation of fresh water. From the scrubber the gas is led to an eight-inch pipe running down through the center of the condenser to the seal at its bottom and the clarified gas leaves the condenser shell through an eight-inch outlet in the side of the shell near the top. Continuing, it passes through the washer and scrubber of the old coal gas set, whence it is carried to the purifiers before being taken to the relief holder. This holder, by the way, has a capacity of 15,000 cubic feet, while the main holder has a capacity of 40,000 cubic feet.

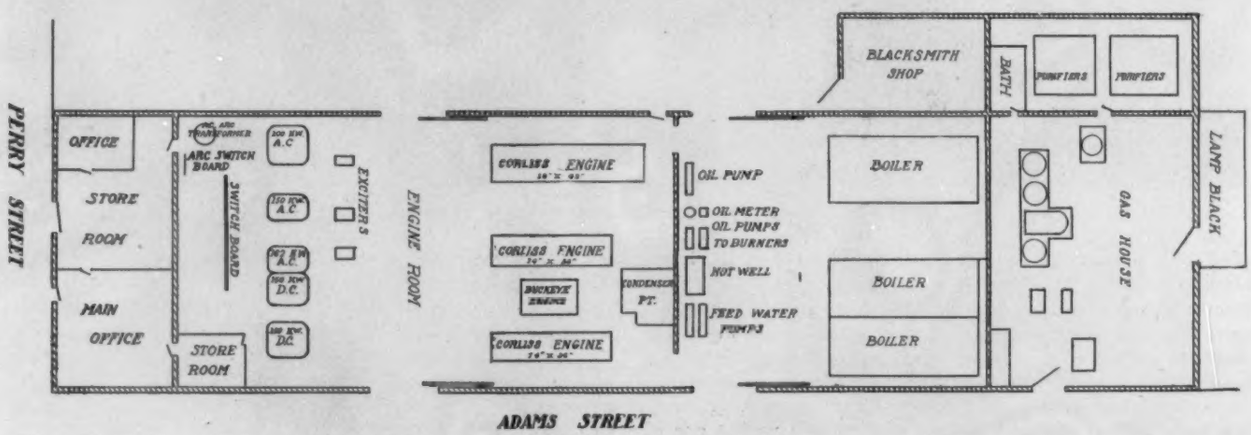
The accompanying table, which is taken from the gas maker's reports on the operation of the new Lowe crude oil gas plant at Salinas, shows the time and fuel efficiencies of the apparatus as operated during the month of July last, and in digesting this table it is well to bear in mind that the plant is operated on an average hardly more than seven and one-half hours a day. This, of course, entails a serious disadvantage in the matter of generator heats. Nevertheless, the results accomplished are favorable, and despite the handicap of a short run, the efficiency of 11.22 gallons of oil per thousand cubic feet of gas produced, indicates that were the apparatus operated under increased output approaching its capacity, its efficiency is fully equal to that reached in any other plant of its size.

TOTALS FROM THE GAS MAKER'S REPORTS FOR JULY, 1904—SALINAS GAS WORKS

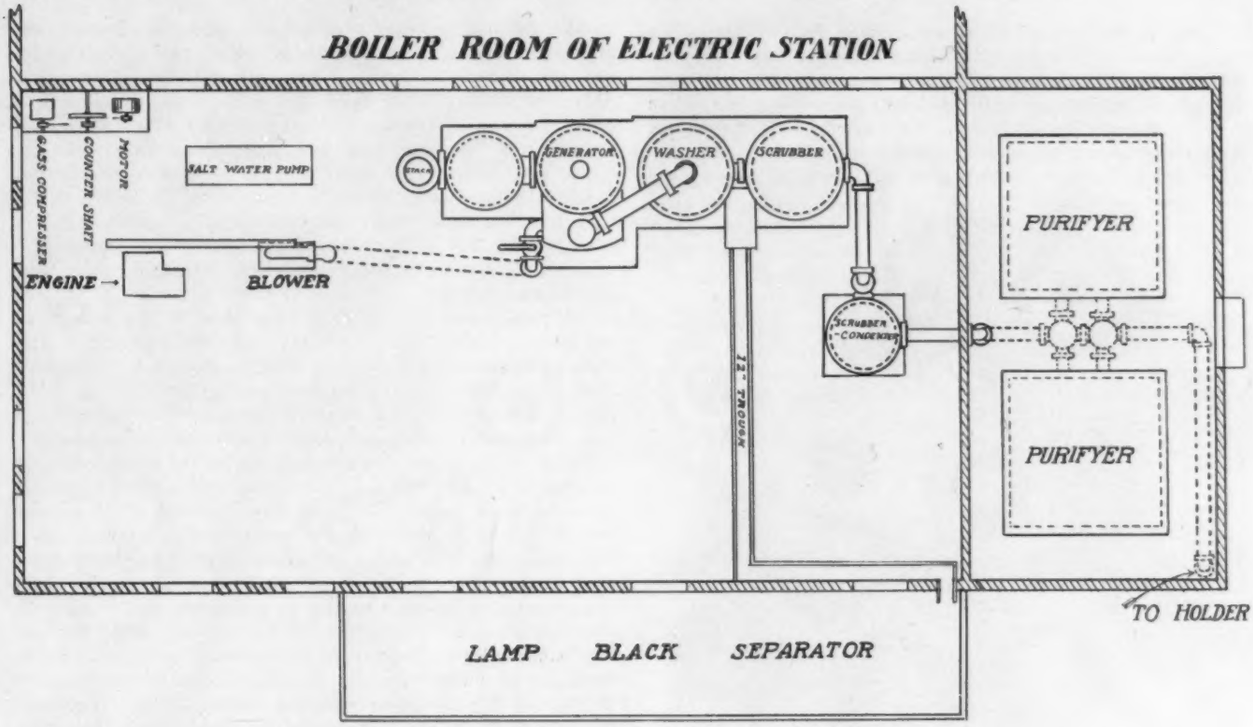
July	Oil in Gallons			Time			Amount Gas Made	Gals. Oil per Thousand Cubic Feet	Candle Power	Temp. Deg. Fahrenheit	Cubic Feet Gas per Hr.
	Heat	Make	Total	Heat	Make	Total					
				h. m.	h. m.	h. m.	cu ft.				
1	92	294	86	2:13	2:31	4:44	34,300	11.31	23	78	7,755
2	111	346	457	2:40	3:21	6:01	41,000	11.12	23	78	6,810
3	66	224	290	1:30	2:00	3:30	24,800	11.69	23	78	7,085
4	117	311	428	2:38	3:31	6:09	40,900	10.45	23	78	6,650
5	104	303	407	2:25	3:30	5:55	37,100	10.99	22	78	6,270
6	98	321	419	2:20	3:12	5:32	36,500	11.23	23	78	6,595
7	90	290	380	2:10	3:13	5:23	35,300	10.76	..	78	6,560
8	116	394	510	3:00	3:59	6:59	43,300	11.75	23	78	6,200
9	85	260	345	2:00	2:40	4:40	29,600	11.66	23	78	6,345
10	85	274	359	2:05	2:38	4:43	30,300	11.85	23	78	6,425
11	95	293	388	2:13	3:03	5:16	33,100	11.72	23	78	6,285
12	90	295	385	2:35	2:46	5:21	33,300	11.56	23	..	6,225
13	93	278	371	2:00	3:02	5:02	33,600	11.14	23	78	6,675
14	122	383	505	2:40	4:20	7:00	47,100	10.72	23	78	6,730
15	67	177	244	1:20	1:28	2:48	20,700	11.03	23	78	7,390
16	99	320	419	2:19	2:59	5:18	39,300	10.67	23	78	7,415
17	73	234	307	1:45	2:15	4:00	27,400	11.02	23	78	6,850
18	102	329	431	2:17	2:58	5:15	37,400	11.53	24	78	6,125
19	101	274	375	2:22	2:25	4:47	34,800	10.78	23	78	7,275
20	97	304	401	2:22	2:33	4:55	35,400	11.33	23	78	7,200
21	91	296	387	2:10	2:53	5:03	34,900	11.09	23	78	6,910
22	73	235	308	1:45	2:30	4:15	36,900	11.94	23	78	8,730
23	82	241	323	2:10	2:36	4:46	29,200	11.06	23	78	6,125
24	75	220	295	1:50	1:55	3:45	26,300	11.22	24	78	7,015
25	88	251	339	2:07	2:15	4:22	27,600	11.27	24	78	6,325
26	97	328	425	2:23	2:37	5:00	34,300	11.42	24	78	6,860
27	85	278	363	1:54	2:19	4:13	32,400	11.20	23	78	7,685
28	85	275	360	2:05	2:22	4:27	32,500	11.07	23	78	7,300
29	96	297	393	2:10	2:44	4:54	36,700	10.72	23	78	7,460
30	95	311	406	2:15	2:35	4:50	37,400	10.86	23	78	7,740
31	92	272	364	2:00	2:30	4:30	34,200	11.65	23	78	7,500
Aver.	93	287	380	2:11	2:46	4:57	34,135.5	11.22	23	78	6,920
Total	2,862	8,908	11,770	67:43	85:40	153:23	1,058,200				

THE STEAM-ELECTRIC PLANT AT MONTEREY.

The gas, electric and street railway plants supplying service to Monterey, New Monterey, Pacific Grove and Hotel Del Monte are located on the block of land bounded by Perry, Adams, Franklin and Figueroa Streets, all of which is owned by the Monterey County Gas and Electric Company, save the single piece of property, measuring 50 by 100 feet that constitutes the southwest corner of the block. The steam, electric and gas plants are located on the southeast corner of the block; that is, on the corner of Perry and Adams Streets, and facing Figueroa Street, within twenty-five feet of the diagonally opposite corner of the block is the company's principal car barn. This is a corrugated iron building, 160 feet long by 32 feet wide and into which are extended



GENERAL ARRANGEMENT OF THE MONTEREY STEAM, GAS AND ELECTRIC WORKS AT MONTEREY



ARRANGEMENT OF THE LOWE CRUDE OIL GAS PLANT AT MONTEREY

two tracks that run over a pit that is 60 feet long by 25 feet wide and 5 feet deep. In addition to this, the company maintains a second car barn near the entrance to the Del Monte grounds.

Work on the erection of the powerhouse was begun on August 4, 1902, and its construction was continued uninterruptedly until it was placed in service on January 26, 1903. The building proper is of brick resting on a heavy concrete foundation, and roofed with corrugated iron supported on wooden trusses. Its dimensions are 52 feet by 143 feet over the electric portion, and at the rear has been built the gas works, occupying a length of 66 feet, which is more than the entire width of the building, by a depth of 28 feet. A substantial fire wall separates the boiler room from the generator room, the former having a depth of 46 feet and its roofs being supported on timber trusses. The length of the generator room is, therefore, 76 feet, and it is floored with concrete which carries not only subways for all interior wiring, but also a pit in which is placed the circulating and condensing apparatus about to be described. In the front part of the building is located the company's office, the storeroom and the testing department. Fifty feet of the length of the building is apportioned for these purposes, and it may be mentioned in particular that the office bears out the legend of the entire structure in its compact and serviceable arrangement.

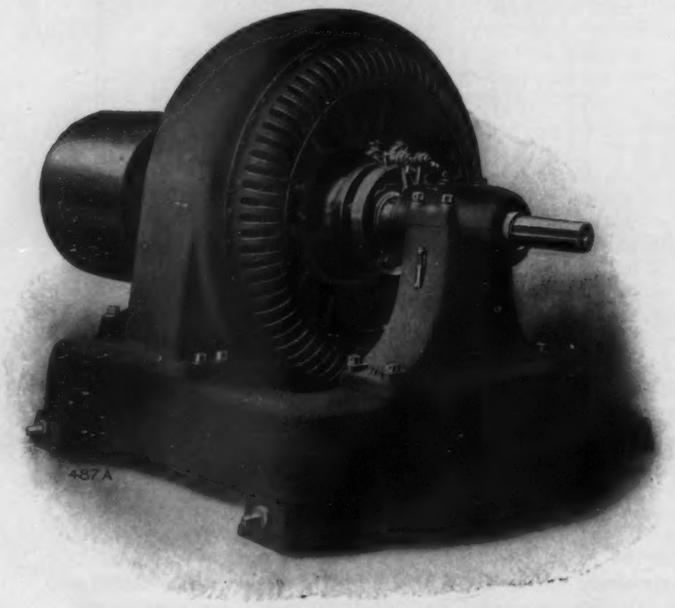
The steam for the operation of the plant is generated by three 150-horsepower return tubular boilers, each of dimensions measuring 18 feet by 72 inches, and which were built by the Murray Iron Works of Burlington, Iowa, to carry a working pressure of 150 pounds per square inch. The boiler room contains space for another battery of three boilers each, of equal size to those already installed. Crude oil is used for fuel, this being pumped direct from tank cars and stored in an oil tank having a depth of seven feet by width of 24 feet, which is located on the company's property about 85 feet from the station, near the center of the company's property. The tank cars are placed on a siding opposite the powerhouse, at a distance of probably 200 feet, and, in order to handle the oil, live steam from the plant is introduced into the heating coils of the tank car, which reduces the viscosity of the oil to a point sufficient to enable it to be handled by the pumps. For this service two Stilwell-Bierce & Smith-Vaile pumps, each measuring 5½ by 3½ by 5 inches, are used, one being always held in reserve. On its way to the boilers the oil is measured through a Worthington meter. The oil used, which is furnished by the Standard Oil Company, costs 76 cents per barrel of 42 gallons, and it varies in gravity from 14 degrees to 15 degrees Beaumé. It is burned by means of a steam spray burner, planned and built by E. De Groat, chief engineer of the Monterey powerhouse. The feed pumps are also two in number, one being a duplex Stilwell-Bierce & Smith-Vaile pump and the other being a single-acting Burnham pump, having dimensions of 2 by 2½ by 7 inches. Another Worthington meter records the amount of feedwater used.

From the boilers the steam pipes enter a common header, running along the engine room side of the fire wall and from which separate lines are taken to the different engines, through Chapman valves. These engines are four in number, the first of which is a 150-horsepower Lane & Bodley Corliss single engine, with a 14 by 36-inch cylinder and which runs at 98 revolutions per minute. Its shaft carries a twelve-foot fly-wheel, on which runs a 22-inch leather belt for driving a 100-kilowatt, 550-volt Thomson-Houston railway generator. The next engine is a single Nagle-Corliss, of the same size and rating as the Lane & Bodley engine, but which runs at a speed of 108 revolutions a minute. This engine drives a 150-kilowatt, composite 2300-volt two-phase General Electric generator, from which the self-exciter has been cut out, and which is now excited from a National direct-current generator, rated at 80 volts and 160 amperes. The third engine, a Weatherill-Corliss, with cylinder measuring 18 by 42 inches, and which runs at 94 revolutions per minute, drives, by belt connection, a 200-kilowatt revolving field, 2300-volt, National two-phaser, about to be described. This machine is excited by a 10-kilowatt National generator, which, though rated at 110 volts, is run so as to deliver 55 volts to the fields of the alternator. The fourth engine is a single Buckeye unit of a capacity of 200 horsepower, which runs at 175 revolutions per minute, and which drives the motor-generator set soon to be referred to.

To revert to the steam plant: the entire equipment is run condensing, salt water for the purpose being pumped from the Bay of Monterey through 900 feet of 8-inch cast iron pipe. Under full load conditions about 700,000 gallons of water pass through the condenser every 24 hours, whence it is continued through about one mile of 8-inch pipe line to the plunge bath of Hotel

Del Monte, reaching there at an average temperature of 84 degrees. The circulating air pumps and the surface condenser used are of Stilwell-Bierce & Smith-Vaile manufacture, and a Cochran oil separator is introduced into the exhaust line before it discharges into the condenser. Feed water is taken from the hot well into which all condensed water is discharged.

The latest machinery installed in the Monterey powerhouse



THE 200-KILOWATT NATIONAL REVOLVING FIELD GENERATOR IN THE MONTEREY POWERHOUSE

represents the newest products of the works of the National Electric Company, of Milwaukee, Wis., and it conforms, of course, to the general type of the plant, which is in 60-cycle, two-phase, 2300-volt service. As has been stated in these columns heretofore, this plant constituted the exhibit of Kilbourne & Clark Company, Pacific Coast agents for the National Electric Company, at the eighth annual convention of the Pacific Coast Electric Transmission Association, held in Monterey in June last, and it proved of double interest to the members of the Convention who inspected it because of the fact that in it was shown for the first time on the Pacific Coast a type of machinery in moderately large sized units that had not been seen in operation theretofore, and because of its remarkably attractive and finely finished appearance, its well proportioned designs, its high efficiency, and in operating remarkably cool in all its parts despite the heavy duty imposed upon it.

In detail, the National machinery there installed consists of a 200-kilowatt generator and a motor-generator set, consisting of a sychronous revolving field motor of a capacity rating at 162 kilowatts, which drives by direct coupling a National 550-volt direct current railway generator with a rating of 150 kilowatts.

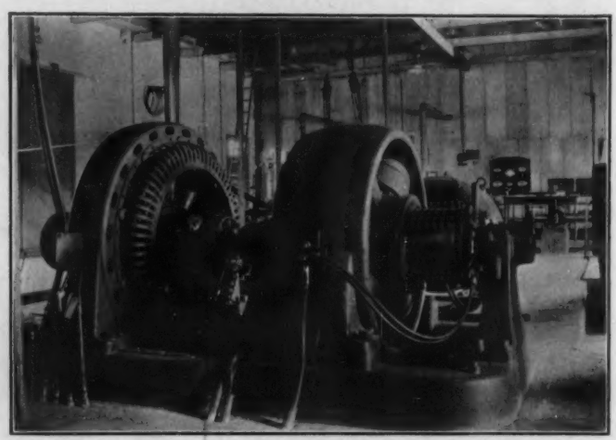
The 200-kilowatt alternating current generator is of the belted type, with two bearings, pulley, slide rails, and belt tightening device, complete in every respect. It is of remarkably substantial construction, and follows very closely the structural design that has become well established in American types of revolving field generators. Its erected weight is 12,850 pounds, and its inherent regulation is well within six per cent at unity power factor. It is run at a speed of 600 revolutions per minute, and consequently to deliver current at a frequency of 60 cycles it is provided with 12 poles on its revolving field. The usual temperature guarantee, namely that with an atmosphere temperature of 25° Centigrade, the temperature of the machine will not rise above 60° Centigrade under a continuous 24-hour run at full normal load, was considerably bettered in that the actual rise under these load conditions was but 22° Centigrade above the temperature of the surrounding air. It fact, it has been found to stand a remarkably heavy overload without serious heating, and in regular service it has often been called upon to operate for considerable periods of time at an overload of over 50 per cent. As to the efficiencies of the generator, they are as follows: 93 per cent at 25 per cent overload; 92.5 per cent at full load; 91.25 per cent at three-quarter load; and 88 per cent at half load.

The exciter runs at a speed of 1,450 revolutions per minute, is normally rated at 12 kilowatts, at 110 volts, and is belt driven from a pulley placed on the end of the generator shaft. It, too, is remarkably cool in its operation, and there are no evidences of sparking or flashing at the commutator, even under conditions of extreme overload.

The motor-generator set runs at a speed of 720 revolutions per minute, and in operation it has been found that the temperature of the sychronous motor does not exceed 25° Centigrade above the temperature of the surrounding air, and the direct current generator does not exceed a rise of 25° Centigrade in any part, when both machines are working under full load conditions.

An interesting feature in connection with the motor-generator set rests in the fact that a 22-inch pulley with a 16-inch face has been placed on the shaft between the motor and generator, and that this pulley is belted to the fly-wheel of a 200-horsepower high-speed Buckeye engine. This gives absolute flexibility to the plant in that during the hours of light load both the units of the motor-generator set may be run as generators, and in that the motor-generator set affords the link by means of which the railway load may be coupled in with the two-phase load, or *vice versa*. Obviously this enables a day alternating current service to be maintained in conjunction with the railway load, at maximum efficiency in operation; and, though the installation of the motor-generator set may appear anomalous in view of the fact that the current for its operation is taken from generators located within the same premises, it is in reality the rational solution of the problems presented by the local conditions which prevail.

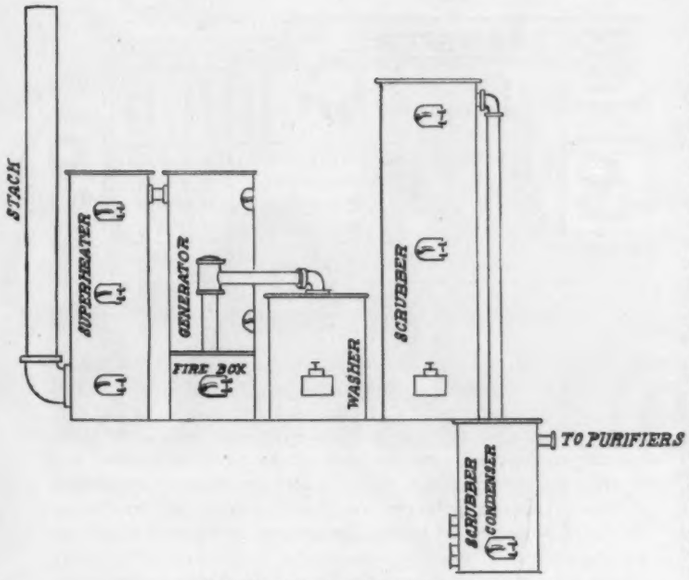
The main switchboard at Monterey is in three panels of Vermont marble, the first of which, beginning the ennumeration of the right hand side, contains four enclosed fuses, two Westinghouse indicating ammeters, one Westinghouse indicating voltmeter, a field rheostat, a voltmeter and synchronizing plugs and oil switches, together with a Westinghouse synchronoscope. Panels 2 and 3, which are alike, each contain four enclosed fuses, two Thomson ammeters, one Thomson voltmeter, a synchronizing lamp, a field switch, an exciter rheostat, synchronizing and volt-



THE 180-KILOWATT NATIONAL MOTOR-GENERATOR SET AT MONTEREY

meter plug switches, a triple pole double throw knife switch for paralleling the exciters, and a main oil switch.

While the satisfactory development of business at Salinas has been due to the liberal attitude taken by the company toward the public as well as to the aggression of the local superintendent, the development of the electrical load at Monterey so far as lighting is concerned is largely attributable to the unusual condition wherein an electrical contractor has



ELEVATION OF THE MONTEREY GAS PLANT

prosecuted an active campaign in the wiring of stores, building and residences, with the result that the local lighting company has reaped the direct benefit of greatly enhanced patronage without effort or solicitation on its part other than the pursuit of a liberal policy in the matter of rates and service connections. This contractor is The H. R. O'Bryan Electrical Works, which keeps well apace with The Monterey County Gas and Electric Company in its spirit of enterprise and progression. It is the only electrical contracting concern in the vicinity and does practically all the electrical construction that is carried on thereabouts.

As may be well understood, the population of Monterey and environs varies greatly with the season of the year, for although their permanent population scarcely aggregates 10,000 souls, that of Pacific Grove alone often reaches 20,000 during the summer months. This presents an anomalous condition in that the peak loads of both lighting and street railway services are reached during the time of the year which are ordinarily the lightest from the central station standpoint.

THE MONTEREY GAS WORKS.

The Monterey gas works may be accepted as typifying the standard of apparatus installed by the California Light & Fuel Company in the early part of 1903, wherein the generator, superheater, washer, scrubber and scrubber-condenser are contained in separate and entirely distinct shells. The apparatus, therefore, consisted of five pieces, the first four of which appear in sequence in the order named, while the scrubber-condenser, the top of which is on the floor level, is placed to one side in the ground plan and elevation appearing in the accompanying drawings. Evidently, then, compactness was not the determining feature in the design of the plant, and in this it follows closely the lines of installation that had become so well established in many of the original Lowe water gas settings.

Reference to the drawings referred to, and particularly to the elevation plan, will enable an understanding to be conveyed as to the manner in which this setting is operated, but this mode of operation does not differ from that followed in the later plant at Salinas. In the generator and superheater, for instance, the only difference existing between the two types of apparatus rests in the fact that at Salinas the superheater, which is surmounted by the stack, is placed on top of the generator, and during the period of blow the combined parts are operated precisely after the manner of the cupola of a foundry. In the Monterey plant, however, the generator is equipped with a fire box, as in the Salinas generator; from the top of the generator a short 12-inch flue is connected to the top of the generator and superheater, and from the bottom of the superheater a 16-inch stack pipe rises through the roof in the manner shown in the elevation plan. During the period of blow the vaporized oil flames upward through the generator, whence it passes through the nipple into the superheater, down which it traverses in order to reach the open air by way of the stack. After sufficient heat has been obtained, the oil, blast and stack valves are closed, steam is introduced into the bottom of the superheater, steam-vaporized oil is injected into the top of the generator, and gas is made in a direction that is the reverse of the current of the blast. The raw gas comes out of the generator through the 8-inch pipe leading from the top of the fire-box, whence it passes through the washer, scrubber, condenser and purifier before being taken to the holder. The *modus operandi* of the Monterey plant is, therefore, identical with that of Salinas, except that at Monterey salt water is used exclusively for all gas-making operations.

In order to enable the comparisons to be made in the operative efficiencies of the Salinas and Monterey plants, there is given herewith, as well, a table compiled from the gas maker's reports of the Monterey plant by days for the month of July last, from which it will be seen that the averages reached in a total production of 531,000 cubic feet of gas made during the month, are as follows:

Average amount of oil used.....210.74 gallons per day.
Average amount of gas made.....17,129 cubic feet per day.
Average amount oil per M. cubic feet of gas made, 12.3 gallons.
Average period of blow.....2 hours and 40 minutes per day.
Average period of make.....2 hours and 5 minutes per day.

AT MONTEREY AT DEL MONTE

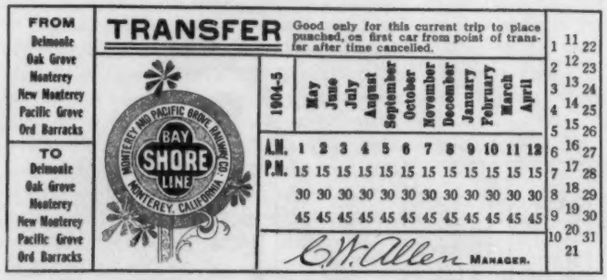
THE TWO CAR BARNS OF THE MONTEREY AND PACIFIC GROVE ELECTRIC RAILWAY COMPANY

TOTALS FROM THE GAS MAKER'S REPORTS FOR JULY, 1904—MONTEREY GAS WORKS

July	Gals. Oil Used	Gas Made	Oil per M	Total Time of Blast	Total Time of Make	Temp. of Oil	Blast Pressure	C.P.
1	182	14.900	12.5	2′49″	1′42″	90°	0.5 lb.	20
2	196	16.800	12.	2′44″	1′49″	85°	0.5 "	20
3	185	14.000	13.	3′	2′1″	85°	0.5 "	20
4	195	15.300	13.	2′57″	1′33″	90°	0.5 "	20
5	205	17.200	12.	3′24″	1′39″	90°	0.5 "	20
6	192	16.300	12.	2′39″	1′57″	90°	0.5 "	20
7	201	16.200	12.5	3′1″	1′55″	85°	0.5 "	20
8	193	16.400	12.	2′41″	1′50″	90°	0.5 "	20
9	205	16.400	12.5	3′18″	2′1″	90°	0.5 "	20
10	175	15.100	11.5	2′17″	1′51″	95°	0.1 "	21
11	198	16.400	12.	3′	1′55″	90°	0.5 "	20
12	209	17.200	12.	3′27″	2′25″	90°	0.5 "	20
13	222	20.600	10.7	3′15″	2′4.″	90°	0.1 "	20
14	206	20.500	10.	2′57″	1′56″	95°	0.1 "	18
15	237	19.400	12.	2′44″	1′51″	100°	0.1 "	21
16	229	16.600	14.	2′43″	1′43″	95°	0.1 "	21
17	218	18.100	12.	2′49″	1′51″	90°	0.1 "	20
18	221	17.100	12.8	2′43″	1′52″	92°	0.1 "	20
19	238	18.800	12.5	2′58″	2′9″	90°	0.1 "	20
20	213	17.400	12.	2′38″	2′9″	90°	0.1 "	21
21	219	17.200	13.	2′56″	2′23″	90°	0.1 "	20
22	193	18.300	10.5	2′39″	1′54″	90°	0.1 "	20
23	232	18.500	13.	3′1″	1′58″	90°	0.1 "	20
24	200	15.600	12.8	2′52″	1′51″	95°	0.1 "	20
25	204	16.800	12.2	2′52″	2′47″	92°	0.1 "	18
26	228	16.600	13.	2′32″	2′39″	86°	0.1 "	20
27	225	15.700	14.	2′28″	2′7″	80°	0.5 "	21
28	218	17.000	12.	2′16″	2′37″	88°	0.1 "	20
29	224	18.400	12.2	2′31″	2′25″	82°	0.1 "	20
30	247	19.400	13.	3′9″	2′28″	82°	0.1 "	20
31	223	16.800	13.	3′15″	2′28″	90°	0.1 "	20
Totals	6,533	531.000	381.7	88′26″	64′32″	2,777°	25 lbs.	621
Aver.	210.74	17.129	12.3	2′40″	2′5″	89.6°	0.8 lbs.	20

The table further shows that the average temperature of the oil used, which is of a specific gravity of 14° B., was 89.6° F.; that the average holder pressure was 1/10 of a pound, and that the average candle power was 20. In this plant no account is taken for the amount of steam used in driving the blower or in making gas, as the steam is taken direct from the boilers of the electric plant, which is in continuous operation. As stated heretofore, these boilers use oil fuel; hence the lampblack that the gas plant produces is not burned, but instead is stored in the yard. This condition, however, does not alter the operative efficiency of 12.3 gallons of oil per thousand feet of gas produced, for the obvious reason that all steam necessary for the operation of the gas works could easily be produced by the burning of the lampblack, were a boiler at hand for that purpose.

No relief holder is used at Monterey, but instead the gas is


FROM
Delmonte
Oak Grove
Monterey
New Monterey
Pacific Grove
Ord Barracks
TO
Delmonte
Oak Grove
Monterey
New Monterey
Pacific Grove
Ord Barracks
TRANSFER
Good only for this current trip to place punched, on first car from point of transfer after time cancelled.
BAY SHORE LINE
MONTEREY AND PACIFIC GROVE RAILWAY
MONTEREY, CALIFORNIA
1904-5
May June July August September October November December January February March April
A.M. 1 2 3 4 5 6 7 8 9 10 11 12
P.M. 15 15 15 15 15 15 15 15 15 15 15 15
30 30 30 30 30 30 30 30 30 30 30 30
45 45 45 45 45 45 45 45 45 45 45 45
C.W. Allen MANAGER.
1 11 22
2 12 23
3 13 24
4 14 25
5 15 26
6 16 27
7 17 28
8 18 29
9 19 30
10 20 31
21

THE MONTEREY AND PACIFIC GROVE RAILWAY COMPANY'S UNIVERSAL TRANSFER

taken from the purifiers and delivered direct to the main holder through a tee drip valve. This holder, which is of a modern and well built type, resting in a wooden tank that stands on the surface of the ground, has a capacity of but 10,000 cubic feet, which is quite inadequate to the demands of the territory covered, but in order to overcome the unsatisfactory condition it is planned to build a materially larger holder at an early date and when the latter is completed to use the present 10,000-foot holder as a relief.

In a corner of the gas works, as shown on the ground plan, is a small exhauster driven from a 7½-horsepower electric motor through a countershaft, which is used in raising the holder pressure of approximately 1/10 of a pound to a pressure to between 1 and 2½ pounds for delivery to the 3-inch pipe line, by means of which the towns of New Monterey and Pacific Grove are supplied with gas. This exhauster runs continuously, and whenever the delivered pressure exceeds 2½ pounds per square inch the gas is automatically by-passed back to the low pressure side. No regulating governors have so far been used on consumers' services on this transmission line, except when gas is used for lighting, for the reason that the pressure losses in transmission are sufficient to reduce the delivered pressure to a point that renders their use unnecessary. They may, however, be added in the future.

THE STREET RAILWAY SYSTEM.

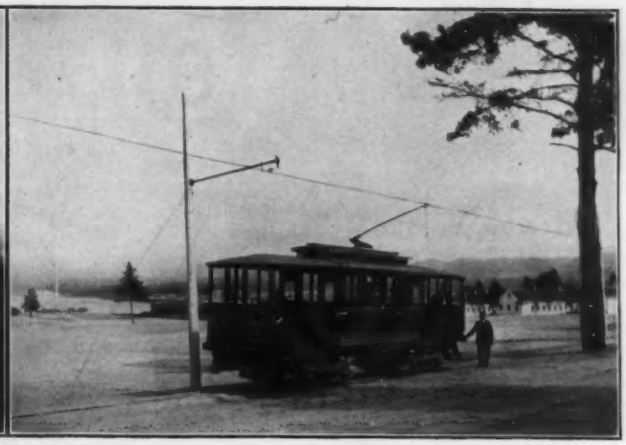
The street railway system of Monterey owes its inception to Juan Malarn, who, in August, 1891, had built and begun the operation of a horse-car line that extended from the Hotel Del Monte to the Pacific Grove. On June 2, 1893, The Monterey and Pacific Grove Electric Power Company was organized and shortly after acquired the roads and franchises of Juan Malarn, which it continued to operate until the fall of 1902, when it passed into the hands of its present owners and was modernized throughout. Under its former ownership but two single horse-cars were ordinarily run, although in the busiest of the season four cars were

"THE MONTEREY," MONTEREY

"EL CARMELO," PACIFIC GROVE

TWO LOCAL HOTELS ON THE ROUTE OF THE MONTEREY RAILROAD

ON THE HILL



AT FORT ORD

THE RECENTLY BUILT EXTENSION TO THE UNITED STATES ARMY RESERVATION AT NEW MONTEREY

run, the interval between them varying from forty minutes in winter to thirty minutes in summer. But even with this indifferent service the road was satisfactory as an investment, for from the outset it declared regular dividends to its stockholders.

During the period of the horse-car in Monterey the towns of Monterey and Pacific Grove were electrically lighted by a small plant situated in Monterey and owned and operated by the Monterey Electric Lighting and Developing Company, whose principal owner and manager was Mr. H. A. Greene. Its plant, which was located in a frame building, occupied a lot fifty by seventy-five feet in size, and situated on a side street. It contained a 54-inch by 15-inch tubular boiler, two simple E. W. Payne engines with cylinders measuring 10x12 and 10½x12 inches respectively, two 15-kilowatt 110-volt Edison bipolar generators, operated on the direct-current three-wire system, one 17½-kilowatt and one 35-kilowatt Thomson-Houston 1,100-volt single phase alternators, with one 1½-kilowatt exciter for them, and the remaining necessary auxiliary steam and electrical appliances. The distribution consisted of five miles of pole line, supporting copper wires of various sizes, from No. 0 to No. 10. For two years prior to February, 1902, this old company had an average gross income of $5,000 per year, of which it earned nearly $1,000.00 per year.

Without question, the greatest factor in the building up of Monterey and Pacific Grove is the conversion of the old horse-car line between the two cities into a modern electric railroad, which was completed in August, 1903. The first step taken in this work was the changing of the route, the line to Del Monte being built from the head of Alvarado Street, along California, Webster and Figueroa Streets, past San Carlos church and school and through an important section of the city, to the original line at Perry Street. The road as now operated starts from the entrance to the Del Monte grounds nearest the hotel, through the beautiful tree bordered streets of Oak Grove to the Del Monte bath house. Proceeding along Perry Street, from the bath house, it passes the Southern Pacific depot, and turning up Figueroa Street, passes the historic mission of San Carlos and the modern school of the same name, and, after traversing the Spanish-built section of the city, runs the entire length of Alvarado Street, where are located the principal business houses, hotels, theatre and the old custom house. From the custom house the line turns up Decatur Street, and thence into Lighthouse road, passing the United States military reservation, where is located the new army post. Along Lighthouse road the cars pass through the beautiful residence section of New Monterey, commanding a magnificent view of the bay and the mountains beyond, to the cavalry camp just above the Chinese fishing village, and thence through a private right of way into Pacific Grove. In Pacific Grove the line runs along Central Avenue, close to the bay, where are located many beautiful residences, and, turning into Fountain Avenue, runs one block southward to Lighthouse Avenue, and thence to the terminus at Seventeenth Street, passing, as in Monterey, the churches, business houses and hotels.

In addition to the main line, the company has within the past few weeks finished a new branch road. which, as a scenic line, will be exceedingly attractive. This road starts at the intersection of Tyler and Franklin Streets, and runs up Franklin Street hill to Calhoun Street, near the western limits of the city. Along Calhoun Street the line runs to the southern boundary of the military reservation, and thence across the reservation to Spencer Street, thus giving the army post connection with the town over two routes. This line, which commands one of the finest views of Monterey, Del Monte, the bay and surrounding country, is 6,500 feet in length.

During the present summer the second extension which has been added to the system, constitutes the line built with 50-lb. rails from the principal business street of Pacific Grove to the Southern Pacific depot, a distance of 2,500 feet, and the third extension consists in a loop 1,000 feet long which traverses Alvarado Street and returns by way of a back thoroughfare to the main line leading to Hotel Del Monte.

The present line has been relaid with 45-pound steel rails and new redwood ties, and the steeper grades have been cut down, at heavy cost, so that the cars may attain greater speed. The roadbed has been solidly constructed, so that cars may be safely run at high speed, and without jar or discomfort to passengers.

The cars in use on the line were built by the St. Louis Car Company of St. Louis, Mo., and are the finest ever used in that part of the State. At present there are eight of them—four open and four combination cars—each thirty-four feet long, and equipped with two 25-horsepower General Electric motors, and

THE OLD CUSTOM HOUSE, MONTEREY

each car is fitted with the best fender obtainable. They are built on the same pattern as the cars used on the Huntington lines in Los Angeles, and are specially heavy and easy riding. The open cars are finished in birdseye maple, and are exceedingly handsome. They are fitted with transverse seats running the full width of the car, and are capable of carrying large numbers of passengers. They have closed ends, and curtains at the side may be pulled down to protect passengers from wind and fog. The combination cars, which are of thoroughly modern design, are finished in cherry and mahogany with a ceiling of birdseye maple and are fitted with comfortable upholstered seats in the closed section. In the open section at each end are double seats on each side of a center aisle, which face in the direction the car is traveling. These cars have arc headlights, glass ends for the protection of the conductor and motorman, and curtains at the side of the open sections may be drawn down, thus inclosing the car entirely in inclement weather.

These cars are all fitted with the Ohmer register, which records the number of passengers carried, number of five and ten-cent fares, school tickets, transfers, etc., by what conductor collected, and on what trip, and the mileage made by the car daily. For the Franklin Street line, lighter cars of the same general design as those now in use are run, two of the cars used on the horsecar line being enlarged, rebuilt and each equipped with two 25-horsepower Walker motors for the purpose. In order to accommodate extra heavy travel on holidays and special occasions, a number of the old cars have been fitted up as trailers.

In addition to the regular cars the company will receive from the St. Louis Car Company, in a short time, the parlor car "Del Monte," a superb product of the car builder's art. This car will be thirty-six feet in length, and will be fitted with every possible convenience and luxury. The windows will be of plate glass, extra large, and the fittings of the car will be of solid bronze. The interior draperies will be of fancy silk and plush. The car will contain twenty rattan chairs, the floor will be carpeted, and at each end will be an open observation section, enclosed to a height of three feet with a grill work of solid bronze. The car will be wired for thirty-six incandescent lights.

In installing the company's system here, its builders have worked with the idea of creating a permanent enterprise, expending the company's money more with a view to future profits than immediate returns, and inaugurating changes calculated to give satisfaction to their patrons in every possible manner.

In the street railroad, the route has been changed so as to serve a larger part of the city, superior equipment has been provided, and the cars have been placed in charge of the most polite motormen and conductors obtainable. Instead of the old horsecar service, giving a car every twenty minutes in summer and every forty minutes in winter, cars run every fifteen minutes, and it is expected that a ten-minute service will be inaugurated within a few months. A late service, too, is maintained, cars running until midnight, in order to accommodate night travel between Pacific Grove and Del Monte, and it is proving a great convenience.

But the most important action taken by the company in regard to the railroad, and which shows most clearly their liberal, business building policy, is the reduction in the fare between Monterey and Pacific Grove from ten to five cents. This has greatly benefitted both towns, and the increased travel caused thereby proves the wisdom of the company in taking the step. The fare between Del Monte and Pacific Grove is still ten cents, but the company are selling books of tickets which reduce the fare one-half, thus giving regular patrons the benefit of a five-cent fare over the whole road.

In the electric lighting business the same liberal policy has been pursued, the company running the lights from sunset to sunrise, instead of to midnight, as formerly. The flat rate for lights which formerly obtained has also been abolished, and the premises of all patrons are supplied with meters, so that the consumer pays only for the light actually consumed.

The price of gas for fuel has been fixed at $1.50 per thousand feet, and consumers will receive the same liberal and courteous treatment accorded patrons of the railway and lighting system.

No city on the Pacific Coast with a population as large as that of Monterey and Pacific Grove combined has so complete and up-to-date a service as that furnished by the Monterey Gas and Electric Company, and this service is certain to become a most important factor in their further upbuilding, for prospective residents of the better class prefer strongly to locate where modern conveniences are obtainable.

ESTIMATION OF SULFUR IN PETROLEUM.*

BY PAUL W. PRUTZMAN

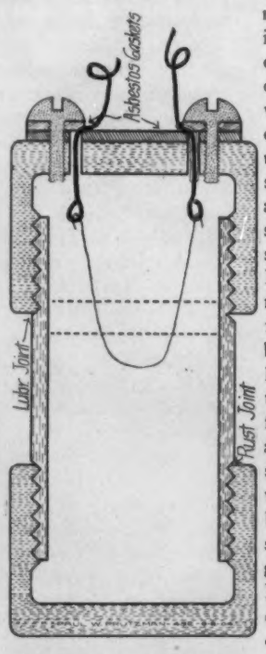
THE use of crude oil for gas making brings into importance the percentage of sulfur contained in the oil. The distillates formerly used for carburetting water gas were relatively free from sulfur, but the heavy crude oils of California contain notable proportions, and as the sulfur in the oil is almost entirely gasified in modern high-temperature processes, the cause of inactivity of the purifiers may often be traced to an excessive proportion of sulfur in the crude.

As a rule the heavier crude oils of California contain more sulfur than the light oils, yet oils of the same gravity, from the same district, will often vary widely in this respect. Out of 50 samples of crude taken at random, 30 samples heavier than 20° and 20 samples lighter than 20° showed the following percentages of sulfur:

	Heavy.	Light.
Maximum	4.43%	2.08%
Minimum	0.34%	0.06%
Average	0.99%	0.73%

An occasional sample will show as high as four per cent sulfur by weight. This would equal (roughly) 155 cubic feet of hydrogen sulfid (H S) per barrel of crude, or 3½ feet per gallon, and would require about 32 pounds of pure dry slacked lime to each barrel of crude.

The following method for estimating sulfur in petroleum is a slight modification of a method for sulfur in coal, described by Mr. Carl Sunstrom in the *Journal of the American Chemical Society*, for February, 1903, and has been used in the writer's laboratory for over a year with very satisfactory results.



BOMB FOR THE ESTIMATION OF SULFUR IN PETROLEUM.
ONE-HALF SIZE.

The bomb shown in the figure is made from a one-inch nipple, two inches long, with a malleable cap on each end (cast caps are likely to crack). The lower cap is rusted on with sal ammoniac, the upper lubricated with graphite. Through the upper cap bore two holes, about one-sixteenth inch, and as close to these as possible tap two small machine screw holes. Pass through the one-sixteenth inch holes short pieces of No. 18 copper wire. One of these may be bare, the other must be carefully insulated from the iron, best by wrapping with thread and shellacking. Pass a piece of thin asbestos over the wires, bend them down flat away from the tapped holes, place another piece of asbestos on top, and screw in tightly machine screws with wide head. The asbestos joint must be gas tight: if not tight on trial, smear the asbestos with litharge and glycerine, or use thicker asbestos. Bend wires inside cap into loops or eyes, and hook into these eyes a loop of the finest iron wire to be had. If the wire is too coarse to fuse at three amperes (110 volts), flatten the point

* From *The Purifier*, San Francisco, for August, 1904.

of loop with light hammer, and trim down with sharp scissors. Connect one outside wire to electric light circuit, pass the other to lamps arranged in multiple, enough lamps being used to pass three or four amperes at the voltage used. Either direct or alternating current may be used. From the lamps, connection is taken through a switch to the circuit.

Weigh out about one gram of the oil on a watch glass, covering with a second glass if the oil is very volatile. Put in small glass mortar about five grams sodium dioxid (Na_2O_2), be sure to keep this tightly sealed when not in use. Clean off the watch glass into the mortar by rubbing small portions of the dioxid over it with pestle into the mortar. When about 15 grams in all of dioxid have been added, grind oil and dioxid well together, and transfer to bomb, tapping down well. Then clean out mortar with about five grams more of the dioxid, and put in bomb, but do not mix with the first added; keep in a separate layer. Screw on top of bomb, being sure that iron wire is long enough to penetrate the lower layer of charge, bury bomb in box of sand, close the switch, and leave closed until lamps go out, showing that fuse has burned. Combustion of charge is instantaneous, and the bomb, which will now be very hot, is disconnected, taken up with tongs, dipped two or three times in cold water, and finally allowed to stand in water until cold.

Sodium dioxid on heating gives up oxygen, being reduced to the monoxid (Na_2O). The carbon of the oil burns to carbon dioxid (CO_2), which unites with the soda to form sodium carbonate (Na_2CO_3). The hydrogen of the oil burns to water (H_2O), the sulfur (in this case) to sulfuric acid (H_2SO_4), which unites with the soda to sodium sulfate (Na_2SO_4).

The cooled bomb is opened by removing upper cap, the melted salts tapped out into a beaker, and dissolved in water. The bomb and cap are placed on their side in a dish or wide beaker, and covered with water. When all the salt has dissolved from iron, which takes several minutes, iron parts are taken out with glass rod, rinsed off with water into beaker, and allowed to dry. Contents of the two beakers are now mixed, and if dirty, as is usually the case, filtered through cotton or glass wool. Hydrochloric acid is now added until effervescence ceases, and the liquid then boiled to expel the last of the carbon dioxid set free by acid. If any precipitate is thrown down on addition of acid, filter again. The solution at this point must be absolutely clear, and distinctly though not strongly acid. Barium chlorid ($BaCl_2$) is then added (about 10 c. c. of saturated solution) and the mixture allowed to stand a couple of hours. The precipitate of barium sulfate ($BaSO_4$) is now collected on an ashless filter, carefully washed, ignited in a platinum crucible and weighed when cool. Multiply the weight of $BaSO_4$ by 0.137, divide by weight of oil taken, and multiply by 100, the result will be percentage of sulfur by weight in the oil.

The proper proportions of oil and dioxide are found only by trial. The mixture should be slightly damp, enough to be cohesive, but not enough to be pasty. If on opening the bomb you find a black deposit on upper cap, use more dioxide the next time. If the dioxid has been exposed to dampness for any length of time, its value is destroyed: if the charge does not burn, use more oil; if it still refuses to burn, get new dioxid. When starting a new can of dioxid, dissolve two grams in water, acidulate with hydrochloric acid, and test for sulfates with barium chlorid. If more than a slight trace is found, estimate the quantity, weigh the amount used in each test, and correct the results accordingly.

ONE OF MANY.

"Allow me to congratulate you (as well as myself) on the very handsome appearance of the August number. I do not remember ever to have had a paper better or more handsomely gotten up than this; probably you know that it is a great satisfaction to the writer to know that his stuff will be properly set and printed, and I am very glad indeed that the publications of the Gas Transactions are to be entrusted to you."

PAUL W. PRUTZMAN.

CALIFORNIA PETROLEUM—A CORRECTION.

In a communication received from the author of the paper read before the Pacific Coast Gas Association on "Notes Regarding California Petroleum," it is pointed out that, owing to a typewriter's error appearing in the original manuscript, the production of refining and fuel oils in the Ventura County district during 1903 is given as 70,000 barrels and 700,000 barrels, respectively. These two terms are reversed, for the production of refining oil in Ventura County during 1903 was 700,000 barrels and that of fuel oil was 70,000 barrels.

The table, in corrected form, is as follows:

TABLE 3—PRODUCTION OF REFINING AND FUEL OILS BY DISTRICTS, 1903.

District.	Refining Barrels.	Fuel Barrels.	Total Barrels.	No. of Wells.	Barrels Per Well.
Coalinga.....	1,200,000	1,000,000	2,200,000	110	67
Kern River	1,000,000	15,500,000	16,500,000	796	69
Sunset.....	25,000	325,000	350,000	102	12
Midway.....	.....	30,000	30,000	24	4
McKittrick.....	250,000	1,120,000	1,370,000	75	61
Los Angeles....	50,000	750,000	800,000	979	3
Whittier	250,000	500,000	750,000	99	25
Puente,.....	120,000		120,000	79	5
Newhall	25,000	25,000	50,000	40	4
Fullerton	450,000	1,000,000	1,450,000	138	35
Summerland ...	20,000	80,000	100,000	198	0.2
Santa Maria....	80,000	40,000	120,000	21	19
Ventura County	700,000	70,000	770,000	306	8
Totals	4,170,000	20,440,000	24,610,000	2,967	27.7

THE OVERPRODUCTION OF CRUDE OIL.

Dr. C. T. Deane, the secretary of the California Petroleum Miners' Association, shows that there are two sides to the controversy which the reduction in the crude oil rates in the Kern oil fields by the Standard and Associated oil companies has created. He says there is merit in the statement of overproduction made by the managers of these two corporations, and that the remedy is to stop drilling new wells until we catch up with the consumption. But the fact remains that the low rate of twelve cents per barrel quoted by the Associated Oil Company, the only purchaser at present in the district, applies exclusively to the Kern River fields, and that its co-operation with the Standard in bearing the market, after previously announcing its willingness to continue buying at fifteen cents per barrel, is suggestive of conspiracy.

Dr. Deane says the oil fields of California are now producing at the rate of 30,000,000 barrels a year, which is entirely disproportionate with the consumption. If this is true, the remedy for the present condition of the Kern oil market is to shorten the supply or expand the field of consumption. *The Bakersfield Californian* continues to cherish the opinion that the remedy lies in the organization and co-operation of the independent well-owners, and the latter have already begun to move in that direction.

The present situation is certainly extraordinary. Before the existence of an unlimited supply of cheap fuel in the State was determined, it was assumed that the expansion of manufacturing was impossible. Now that the cheapest kind of fuel is available and superabundant, this expansion ought to be stimulated, but it is not keeping pace with fuel production. And the railroads are making no special effort to encourage local manufacturing, which they could readily do by hauling cotton and other raw manufacturing materials from Eastern and Southern States at low rates in the cars which are now returned as "empties." If the transcontinental lines were to adopt that policy, it would doubtless add new manufactories to our industries, create a home market for the consumption of our fuel oil and make new business for themselves.—*San Francisco Chronicle, September 1, 1904.*

Mr. Louis C. Ralston, formerly with the California Gas and Electric Corporation, has taken a position in the sales department of the California Electrical Works.

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VOLUME XIV SEPTEMBER, 1904 NUMBER 9

EDITORIAL.

THE TRANSMISSION OF CRUDE OIL.

A six-inch pipe line, 110 miles long, is being laid from Coalinga, in Fresno County, California, to Monterey for the purpose of transmitting the crude oil of the Coalinga fields to tidewater and thence in tank ships to San Francisco and other coast markets; and in its installation a great independent oil pipe line is being inaugurated.

But the Bakersfield-Point Richmond pipe line, if reports believed to be correct are credited, has proven to the Standard Oil Company at least that Eastern engineering methods are not always applicable to Western conditions. As originally installed, this great pipe line, traversing some three hundred odd miles of the length of the State, was equipped with eight pumping stations for the purpose of forcing oil from the Kern fields to tidewater on the Bay of San Francisco. These stations each have a capacity of 160 horsepower, and the oil they pump, which was preheated by the exhaust steam, was delivered to the pipe line at pressures varying from 500 to 600 pounds per square inch in summer, to a pressure as high as 1,000 pounds per square inch in winter. Although Kern County oil reached Point Richmond from Bakersfield, it was not in commercial quantities; hence, as originally planned, the pipe line was a failure. Then the number of these pumping stations was increased to fifteen, but the viscosity of the Kern oil was still not satisfactorily overcome, and for several months past the oil that has been sent to Point Richmond has mainly been the far lighter oils of the Coalinga fields.

Now comes the report that as a final effort to make the transportation of Kern County oil to Point Richmond by pipe line pay, the number of pumping stations is to be increased from fifteen to thirty, or practically one station to each ten miles.

In the light of this experience, need electric transmission fear competition, at one time threatened, from the transmission of low gravity crude oil by pipe lines from the oil fields to the power market?

THE MODERNIZATION OF MONTEREY.

Monterey County, so lavishly endowed in natural advantages, yet for a century and more typifying human sluggishness, is at last awakening to a realization of its magnificent resources, an awakening that is especially due to three potent influences: first, to the Pacific Improvement Company, which has expended millions in Hotel Del Monte, its environs and the Carmel water system; second, to Claus Spreckels, who has expended other millions in creating its great beet sugar industry; and third, to The Monterey County Gas and Electric Company, which is actively developing the power engineering possibilities of the region through the installation of water, gas, electric and railway services in and between its important localities. Of these influences, naught need here be said relative to the first two, for their magnitude and importance are already famed, but of the achievements and plans of The Monterey County Gas and Electric Company, it is to be recorded that up to the present time they have remained unheralded outside of its own local sphere.

As a general rule engineering articles of a descriptive nature sink to a commonplace level when confined to the details of a specific form of apparatus, and especially is this true in regard to electrical equipments which have reached a sufficiently high plane of standardization to enable a mere mention of their names and types to convey to the engineer a full knowledge of their structural details. It is *the new* that is now sought in electrical literature—the new of assembly detail, the new of local ingenuity, the new of enhanced efficiencies, and the new of corporate exploitation. Gas engineering follows a similar trend, but it is in a transitory stage in that coal gas is a process of the past and water gas perhaps is still that of the present, with honors to be shared with crude oil gas, the future of which is most promising. At least this is the situation so far as the gas conditions of the West are concerned, in view of which the literature of gas engineering must perforce be one of detailing the apparatus of the present.

While discussing the subject of gas processes, it may be remarked parenthetically, though at the risk of deviating from the main subject, that while alluding to the extent to which crude oil gas is made and used in California, reference was made in these columns last month to the effect that in California, where crude oil gas has become of general use, water gas "has slipped back almost to the level of coal gas in the local fitness of things," and surely this statement is true, if the preponderating number of crude oil gas plants is any criterion of the relative merits and relative efficiencies of these two most

important methods of gas manufacture. It is also undoubtedly true that Lowe water gas apparatus has constituted an absolute standard process these ten years past. Can it be said with equal verity that crude oil gas apparatus has reached its final and standard form, or that it is otherwise than still in a period of development? All will admit that its future is, as stated, highly promising, every one knows that to-day it is by long odds the most generally used in California, but where is the free lance who knows of his own experience that under conditions of equality the one is a more satisfactory and a more efficient gasmaking process than the other? It is indeed a subject of intense interest and concern, and being such it is one regarding which these columns will shirk neither responsibility nor effort in their aim to disclose engineering facts.

But to revert to the original subject, the mode of treatment in the second paragraph above has been closely followed in the article that appears elsewhere in this issue descriptive of the properties of The Monterey Gas and Electric Company. Aside from its engineering interest it should be indicated that the theme which prevails throughout the article is to be found in the fact that prior to three years or less ago the people of "quaint old Monterey" pursued the even tenors of their ways quietly and demurely,—somnolently, if you will—until a group of capitalists with keen foresight seized upon its struggling electric lighting and horse-car industries and transformed them, with all the speed and thoroughness that money and brains could command, into models of engineering refinement in their respective directions.

So well has this been done that its details deserve more than passing reference, not only for their interest, but for their precept in illustration of the up-building of a most staid and substantial property from enterprises which have theretofore been but indifferently successful. A little less than three years ago a bedraggled horse-car line was maintained on a drowsy forty-minute service and an electric lighting plant was operated in a more or less desultory way. These constituted all that the town of Monterey possessed in the way of local transportation and artificial lighting development. Then came the change. Modern methods supplanted the old, gas works were built, the prices for light and fuel were reduced to the lowest point commensurate with reasonably profitable operation, and the business grew by leaps and bounds. In the meantime an opportunity was presented for the purchase of the gas, electric and water works at Salinas, which was done, and under the fostering care of progressive engineering methods, coupled with a liberal attitude toward the public, the success achieved at Monterey was repeated, until the quasi-public services of both localities not only won their way to the highest popular esteem, but at the same time proved the wisdom of their promoters by giving satisfactory returns on the investments that were made.

But thus far only the opening of the new era of prosperity has been inaugurated along these lines in Monterey County, for there is every reason to believe that extension will be the watchword of The Monterey County Gas and Electric Company. First and most important among its projects will be the tying together of Salinas and Monterey by means of a transmission line in order to enable the operation of the electrical industries of Salinas from the steam-driven plant at Monterey which, being located at tide water and forming the terminus of the pipe line from the oil fields of Coalinga (oil will be delivered at Monterey at fifty cents per barrel) will enable the production of power at a far less cost than could be done in two plants located at Monterey and Salinas respectively, to say nothing of the improvement in load factor which would result therefrom. This done, the next step in local development is planned to consist of the building of a twenty-mile electric railway from Salinas to Monterey, by way of Seaside—an enterprise which cannot be otherwise than highly remunerative for several important reasons. The land throughout the Salinas Valley is of high agricultural value and its products rank among the finest in the State. The projected electric railroad, in conjunction with ocean transportation from Monterey to San Francisco, will afford an independent outlet for these products to the metropolis of the State. The city of Salinas, being well inland, will be brought within an hour of Monterey, which means that during the summer months, and particularly on Sundays and holidays, hundreds and hundreds of the people of Salinas will visit the ocean beach at Monterey, while on the other hand, as Salinas is the countyseat, the railroad will afford a direct means for reaching it independent of the circuitous route of the Southern Pacific Company, to avail oneself of which requires a full day's time for the round trip.

Still another railway line is planned, namely that which will parallel the famous seventeen-mile drive along the most beautiful piece of coast line that the Pacific washes on the shores of California. This line will start at Monterey and pass the new and beautiful town of Carmel-by-the-Sea on its way to Carmel Mission, where lie the bones of Junipero Serra, founder of California's early Spanish Missions. The projected line from Monterey to the Carmel Mission will be the scenic line *par excellence* of all California's electric railways. As such it will be essentially a tourists' road, affording incidentally an exclusive outlet to Monterey, which will be availed of by the people of Carmel Valley in the shipment of their farm products. Picturesque as this line will be, its surveys show it to be of surprisingly easy grades and curvatures, despite the fact of its rugged if not sublime surroundings.

Here, then, is an object lesson in practical results to be derived from the enlightened development of dormant resources. Monterey and Salinas are not alone in this: everywhere lie similar possibilities, but Monterey and Salinas are certainly among the foremost to point out the way for capital to find safe and sure investments in the great work which is being undertaken in bringing California to the proud position of being one of the foremost in the great sisterhood of States.

The Pacific Coast Gas Association.

A Full Report of the Discussions Held upon the Papers Presented before Its Twelfth Annual Meeting, San Francisco, July 19-20, 1904.

The twelfth annual session of the Pacific Coast Gas Association was held at the Mechanics' Institute, July 19, 1904. The meeting was called to order by President Aldrich at 10:20 a. m.

THE PRESIDENT—It is with very great pleasure that I welcome the large attendance of members and visitors to this, the twelfth annual meeting. The roll-call is first on our order of business.

On motion of Mr. Martin the formal roll-call was omitted. The following members were in attendance:

Adams, H. E.
Alden, S. F.
Aldrich, W. A.
Alstron, W. F.
Arques, C. L.
Barrett, Wm. G., Hon.
Beck, A. C.
Biggerstaff, E. K.
Boardman, W. F.
Britton, John A.
Brouse, E. H.
Burkhardt, H. W.
Byerly, H. O.
Carrigan, A.
Casey, Wm. J.
Chapin, W. W.
Cheffins, E. F.
Clark, O. E.
Clements, John
Colquhoun, Geo. S.
Conlisk, C. W.
Cressey, F. A., Jr.
Cushing, S. B.
de Sabla, E. J.
Dill, W. N.
Doherty, H. L.
Druffel, D. O.
Du Val, Wm.
Eichbaum, F. H., Hon.
Feist, Adolph
Fitzpatrick, F. E.
Foveaux, Frank
Froelich, Christian
Gillespie, W. W.
Godon, Geo. E.
Grimwood, Chas. P.
Grover, Sherwood
Gunder, W. T.
Guthrie, Samuel
Gutsch, A.
Hargreaves, Robt. H.
Hill, Wm. H. P.
Holberton, Geo. C.
Hollidge, Geo. H.
Hughes, Charles
Jones, E. C.
Jones, F. C.
Kahn, Lazard
Kaneen, John S.
Keyes, Henry C.
Keyes, H. F.
Kirk, George
Leach, F. A., Jr.
Lloyd, A. J.
Lowe, L. P.
Lowe, S. C.
Low, Geo. P.
Malloch, Henry
Martin, John
Matthiesen, A. J. P.
Miller, C. O. G.
Newbert, L. H.
Parker, T. R.
Pedersen, B. S.
Pennoyer, C. H.
Poingdestre, J. E.
Quilty, C. W.
Randall, E. C.
Rice, A. L.
Riffle, Franklin
Roper, Geo. D.
Ross, F. A.
Sterling, R. H.
Symmes, F. J.
Thomas, John W.
Thompson, Geo.
Thompson, Robert J.
Valentine, R. P.
Vanderwhite, A. J.
Wanzer, H. S.
Weber, Hermann
Werry, John
White, W. A.
Wiester, W. H.
Wilson, G. W.

The following associate members were represented:

Chico Gas and Electric Company, A. J. Stephens, Chico, Cal.
Colusa Gas and Electric Co., J. D. Kuster, Colusa, Cal.
Nevada Co. Gas and Electric Co., John Werry, Nevada City, Cal.
Nevada Co. Gas and Electric Co., J. E. Poingdestre, Grass Valley, Cal.
Petaluma Gas and Electric Co., H. Weber, Petaluma, Cal.
San Francisco Gas and Electric Co., W. J. Wrenn, San Francisco.
San Luis Gas Co., R. N. Frick and B. F. Thomas, San Luis Obispo, Cal.
San Rafael Gas and Electric Light Co., F. E. Fitzpatrick, San Rafael, Cal.
Spokane Gas Co., W. A. Aldrich, Spokane, Wash.
Stockton Gas and Electric Co, H. E. Adams, Stockton, Cal.
Suburban Electric Light Co., Wm. Angus, San Leandro, Cal.
United Gas and Electric Co., C. H. Pennoyer, San Jose, Cal.
Woodland Gas and Electric Co., W. E. Osborn, Woodland, Cal.
Sacramento Electric, Gas and Railway Co., F. A. Ross, Sacramento, Cal.

On motion of Mr. Britton the reading of the minutes of the last session was omitted, the proceedings of the Association having already been published in pamphlet form.

THE SECRETARY—In the matter of the reading of the minutes I would like to submit to the Association the minutes of the two meetings of the Board of Directors, as dealing with matters that are pertinent to the meeting.

On motion of Mr. Martin the resolutions recommended in the reports were unanimously adopted.

The Secretary then read his reports as Secretary and Treasurer.

The report of the Board of Directors was then read by the Secretary.

On motion of Mr. Valentine, seconded by Mr. Martin, the reports were accepted and placed on file and the recommendations of the Directors were concurred in.

The report of the Library Committee was presented by Mr. E. C. Jones.

SAN FRANCISCO, CAL., July 18, 1904.

To the President and Members of the Pacific Coast Gas Association.

Your committee, appointed at the eleventh annual session for the purpose of determining ways and means for the establishment of a Bureau of Information and Headquarters of the Association, begs leave to report that after many sessions following the annual meeting, it was determined to send out circulars to the different gas companies in this district, and also to private firms and individuals looking to the obtaining of subscriptions which would be necessary for the proper establishment of headquarters; and on October 23, 1903, and again on February 16, 1904, letters were sent to sixty-two companies, firms and individuals, with the result that but thirteen replies were received, seven of these responding with subscriptions and the other six either evading the issue or declining. The total amount of subscriptions received was as follows:

California Gas and Electric Corporation	$250.00
Oakland Gas, Light and Heat Company	250.00
John Martin	250.00
W. A. Aldrich	100.00
L. P. Lowe	100.00
E. C. Jones	100.00
John A. Britton	100.00
Dunham, Carrigan & Hayden Co.	25.00
Frank A. Cressey	25.00
Phoenix Light and Fuel Company	25.00
Jackson Gas Light Company	10.00
Suburban Electric Light Company	25.00
Pajaro Gas and Electric Light Company	25.00
Christian Froelich	25.00
Thomas Day Company	25.00
Tacoma Gas and Electric Light Company	25.00
C. E. Burrows	20.00
Sacramento Natural Gas Company	50.00
John A. Roebling's Sons Company	25.00
Baker & Hamilton	25.00
Oroville Light and Water Company	10.00
Whittier Light and Fuel Company	10.00

Riverside Light and Fuel Company 10.00
Pacific Hardware and Steel Company..... 25.00

Making an aggregate of $1,535.00, which amount being totally inadequate to sustain the bureau upon the plans designed by your committee, the above subscriptions were cancelled and the cash paid in duly returned to the subscribers.

It would seem as if the gas companies of the Coast and commercial bodies were entirely insensible of the very great good which would accrue by such a headquarters as was proposed. It is therefore with regret that your committee reports upon its failure to establish such a necessary adjunct and requests to be discharged.

E. C. JONES,
L. P. LOWE,
GEO. C. HOLBERTON,
C. H. PENNOYER,
JNO. MARTIN,
JOHN A. BRITTON.

On motion of Mr. Martin the report was received and placed on file.

The Secretary then read the report of the Committee on Headquarters.

MR. BRITTON—I move that the report be placed on file and the committee relieved from further labor.

THE PRESIDENT—I don't know that this is the proper method of disposing of such an important subject. But I am not in a position where I can say anything other than that I would suggest that this matter be laid over, and that the gentlemen who in the past year have worked so hard and faithfully should be asked to have another try at it during the coming year. I feel sure that this work can be brought to a successful conclusion. However, these are only my own sentiments. I would ask your pleasure as to what you wish done with this report.

MR. LOWE—I want to second the motion. I do so because the committee are firmly of the opinion that it is useless to try to raise the sum,—about $3,000 a year for five years. We felt that if we had $3,000 a year guaranteed for five years, we should by that time have grown so that we should be self-supporting. But I do not believe there is sufficient interest in the matter to make it possible to get the guarantee fund. The committee were very, very much disappointed. We thought it would be an easy matter to raise the required amount; but since finding it so difficult, we feared that possibly at the end of the five years the matter would die a natural death; and if that is to be the case, we would better not take it up. I hardly think the time is ripe for carrying out the plan. It has been Mr. Britton's pet scheme, and it seemed as though everyone would flock to it immediately. But as a matter of fact it has received very scant support. I think Mr. Britton should speak on the subject.

MR. BRITTON—I can not enlarge upon what Mr. Lowe has said and what was contained in the report. It was not through incapacity and lack of effort that the thing failed. I personally interviewed a large number of people and sent out personal letters in addition to the circulars; but the members did not seem to rise to the occasion. You all know what I think of the plan. It was advocated in my report when I was president of the Association. The commercial bodies of San Francisco alone ought to support an institution of that kind if they could look at it from a purely business standpoint. It would give them larger sales; it would mean the practical consolidation of the purchasing departments of the companies; it would give them an opportunity to enjoy a headquarters in San Francisco, instead of floating around loosely, as they now have to; they would have fine engineers at their command, who would answer questions gratuitously; and anyone would save ten times over the subscription asked. I rated the subscriptions requested on the basis of the send-out of each company, asking them for so much per annum, and I kept at it conscientiously for six or seven months; and I, for one, would not waste any more time endeavoring to better people who won't be bettered. I am perfectly willing to give up my pet scheme.

THE PRESIDENT—After hearing the remarks of the Vice-President and Secretary, I don't think it would be worth while to discuss the subject further.

Mr. Britton's motion was then carried.

The report of the Advisory Board was then read by the Secretary.

SAN FRANCISCO, July 18th, 1904.

The undersigned appointed at the meeting of 1903 as an Advisory Board, whose particular sphere of action was to assist the members during the year in solving perplexing problems in connection with the gas business, beg leave to report that during the past year they have answered many and various questions of import to the members, and believing that the assistance, such as it has been able to give, is of great benefit to the members of the Association, hereby recommend that the Advisory Board be continued during the coming fiscal year.

E. C. JONES,
JOHN A. BRITTON.

On motion of Mr. Martin the report was accepted and its recommendations adopted.

A letter from Mr. Grimwood was read by the Secretary, who also announced that Mr. Booth was seriously ill and would be unable to deliver the lecture on Radium in the evening.

MR. LOWE—I am sure we are all very sorry to hear of the illness of Mr. Booth. I think we should tender him a sincere vote of thanks for his good intentions and express our regrets for his illness. Carried.

The Secretary then read the names of those recommended by the Board of Directors for election as members of the Association.

On motion of Mr. Britton those whose names were read by the Secretary as having been approved by the Directors for election to membership were declared duly elected to membership in the Association.

President Aldrich then read his Presidential Address.*

ACTING PRESIDENT LOWE—Gentlemen, you have listened to a very interesting Presidential address and one certainly characteristic of our beloved President. As a committee on the President's address I will appoint: Mr. Pennoyer, Mr. Boardman, Mr. Keyes.

The President then presented his report on his visit to the Congress of Gas Engineers at St. Louis.

SAN FRANCISCO, CAL., July 18, 1904.

Members of Pacific Coast Gas Association,
San Francisco, Cal.

GENTLEMEN:

As one of the representatives of this Association I attended the Congress of the Gas Associations of America, held at St. Louis on June 15th and 16th. The proceedings will be published, and it is unnecessary for me to make any extended report. I would say, however, it is a mistake to hold a Congress during a great exposition, as the time devoted to the reading of papers, and subsequent discussions, is necessarily curtailed, owing to the greater attractions outside. The papers read were all of general interest to the gas industry, and with the exception of the paper read by Mr. Henry L. Doherty, comment is unnecessary. This paper (read by Mr. Doherty) was on "Gas Association Work," and discussed the question very thoroughly, the tenor of it being the necessity of concentration of all the Gas Associations of America into one National Association. Following the reading of the paper, over which the speaker had the honor to preside, the following resolutions were proposed and unanimously adopted:

"*Resolved,* That it is the sense of this body that all of the gas men in North America should be united in one Association, with local chapters where conditions make them desirable.

"*Resolved,* That a committee be appointed by the presidents of this Congress, consisting of two members of each Association and three members representing the gas industry at large, which committee shall draw up a comprehensive plan for a single Gas Asso-

* THE JOURNAL, August, 1904, page 283.

ciation, to be composed of the men engaged in the gas industry in North America; the plan to be submitted to each of the now existing Gas Associations for ratification or amendment, the committee to remain in existence and to continue to represent this Congress until such time as the new Association has been organized and is in working order.

"In order to make this matter complete, I would like further to move that the Secretary of this Congress be authorized and instructed to act as the secretary for this committee, the compensation of the secretary to be arranged for."

Upon my return home I received a communication from the Secretary of the Congress requesting action on the above resolutions.

Without a doubt the paper read by Mr. Doherty was prompted by the absence of interest at the various Association meetings, and as the annual conventions were held in too close date proximity, in the opinion of the speaker, whatever may be the conditions causing the unsatisfactory attendance when papers affecting the vital interests of the gas world are being read, this is not within the province of this report. Certain it is that I cannot recommend the panacea offered by Mr. Doherty of the National Association.

The territory comprising the scope of the Pacific Coast Gas Association, Montana, Washington, Oregon and California, is so geographically situated, and our proceedings so spontaneous and democratic, where every member, regardless of his official position, be he a new or an old member, is encouraged to give full expression to his ideas, where we have a full attendance at each meeting, where the interest is sustained from the time the president takes the chair to the time his successor is appointed, making our position so unique that I cannot recommend this Association to accept the invitation contained in the set of resolutions presented at the Congress and passed almost without discussion.

The gas appliance exhibit was very creditable and it is to be regretted that more space could not be devoted to it, which the importance of the industry demands. The gas companies and manufacturers of gas appliances lost a grand opportunity of educating the public to the great advantages of gas for street lighting, stores, residences, and for cooking and heating.

In conclusion I have to report that your president has taken no action with reference to the appointment of committees as set forth in the above set of resolutions, as it is a matter which should be decided by this Association.

All of which is respectfully submitted,

W. A. ALDRICH,
President Pacific Coast Gas Association.

ACTING PRESIDENT LOWE—As a committee who will report during the session I will appoint Mr. Martin, Mr. Jones and Mr. Britton as representative of the Association and of the gas interests at large. I am very glad to see that we have Mr. Doherty with us. The subject is one that is close to his heart. In his recommendations on the matter he has given us what he believes to be for the best interests of the fraternity. After we have received the report the question should be given full discussion, and I am sure Mr. Doherty will have something to tell us.

A paper on the Benefits of Consolidation was then read by Mr. John Martin.*

THE PRESIDENT—Gentlemen, here is a paper such as we can expect from such a broad-minded man as the Vice-President of the California Gas and Electric Corporation. He has showed very clearly how every interest is protected and how easy it is for many companies to be under one great head. Now, gentlemen, the paper is before you for discussion, and I hope to have a very free expression of opinion.

MR. C. O. G. MILLER—I listened to the paper with a great deal of pleasure. I think it is a very good account of the benefits of consolidation. But as an old gas man I want to protest just a little against Mr. Martin's description of what took place at the first convention. I do not think that the gas people there did speak of the Welsbach light as slightingly as Mr. Martin states. I think they realized the value of the burner. The company I was connected with did a great deal to introduce it. And the companies in San Francisco never lost sight of the fact that business and profits were increased by seeking consumers. Mr. Martin's remarks about reduction in price are splendid. I agree with him that a reduction in price does increase business and increase profits. But the gas companies in this State have gone through a period of change in the last few years which has not come entirely by new blood. It has come by changed conditions. We have had a large increase in population. We have developed a large amount of oil here. Oil for a great many years sold at $3 a barrel. I was connected with a company for a great many years that bought 30,000 or 40,000 barrels a year at $3 a barrel. I think we figured we had bought 500,000 barrels at that rate. That is not as conducive to low prices as oil at 65 cents a barrel. There are many things which have changed the situation here, and it may look to the casual observer as if the gas man fifteen or twenty years ago was not attending to his business. These things have been welcomed by a great many gas men. Some have not taken advantage of them, and they have suffered. I think Mr. Martin's paper is an excellent one and I agree heartily with it.

MR. JONES—I rise in defense of the "D. D. & F. S." gas works, the "dirty, dingy and foul smelling" gas works. There was a time when that applied properly; but I think that time has now gone by and the time has arrived when we try to keep our works in order and everything that is volatile or filthy is used up inside the apparatus, instead of being spread about on the ground. I think that the general condition of a gas works as to cleanliness and order indicates the condition of the business to a large extent. I have always found that where a piece of apparatus is well painted and cared for on the outside, and there are not too many coats of paint over the joints of the man-hole plates, the inside of the apparatus is apt to be in the same condition. In regard to reductions in the price of gas, my Eastern experience among directors who feared that reducing the price of gas would reduce the revenue the amount of gas sold times the reduction (and it was always figured that way) has been that we have never known on account of diminution of revenue that the price of gas has been reduced. The people have come forward and appreciated the good work and intent of the gas company; and until the point of saturation—that amount of gas actually needed for lighting and heating and cooking—is reached, we will not notice in our revenue any reasonable reduction in the price of gas.

MR. KAHN—Mr. Chairman and Gentlemen: The subject of consolidation deserves a great deal of attention. It is uppermost in the minds of all thinkers. It is with us, and it concerns every man, woman and child living in this or in any other civilized country; and it is well, Mr. Chairman, that your Association should be considering its merits and its demerits. Consolidation is with us in all industries and in all branches of human activity. It has commanded the best thought of the best men and it has given pause to a great many who see in that marvelous development of a new commercial force a great deal of good and a great deal of harm. I am not prepared, Mr. Chairman, to discuss at length or in detail the question of consolidation as it may apply to any particular industry, especially if that industry exists in and concerns largely only the coast of this great Pacific. It is certain, however, that it signifies to me a great deal when I find, after crossing this vast continent of ours from the shores of the Ohio, that this same question is a vital and a pressing issue here. It is proof to me that the same conditions which prevail in the East and in the larger centers of population are pressing here with all their strenuous requirements and demands upon the social conditions of your new and great country. The great trouble, Mr. Chairman, as I see it, with consolidations is, not that they are not a benefit, not that the consolidation is not capable of accomplishing that which no individual could accomplish,—for these things can not be gainsaid.—Why, Mr. Chairman, when you analyze the proposition, the government of the United States and every other

*THE JOURNAL, August, 1904, page 285.

government is nothing more or less than a consolidation. We recognize but one central authority, and the laws of Congress are the laws of and for a consolidation of untold interests. The railroads that cross from the Pacific to the Atlantic, the steamboats that cross the oceans, the railroad bridges and all the great works that challenge the admiration of the world could not have been put into their places and could not render the service that they do to mankind had it not been for combined power and co-operation, which is nothing more or less than another word for consolidation. The great trouble, Mr. Chairman, is that consolidation, as we understand it in the East, has been badly abused. The people who have taken this consolidation in hand have, as a rule, misunderstood the high mission for which they were organized, and by some great mistakes have brought that great power, that great modern force, into considerable disrepute. It is not because of any inherent defect in the principle, but because they have abused opportunities that should have been turned to far better account, in many instances, than they have been. The good that may be accomplished is vast, and I need not tell you, Mr. Chairman, that the life and the success and the fair name of consolidation depends, and must necessarily depend, upon the character and the degree of service that they render to the country and to the people. If they will vindicate themselves in that sense, if they will accomplish greater good than the individual ever has been able to accomplish, you can depend upon it that no power on earth can stop the onward march of consolidation in all avenues of activity. And in my own opinion, and in the opinion of many people, it is the coming solution of vast problems, none of which is greater than the one so splendidly referred to by our worthy presiding officer when he stated to you the suggestions that were made to him by the president of the Metropolitan Gas Company of London. I know of no way, Mr. President and Gentlemen, to solve that problem, the relation of capital and labor, so thoroughly and so well as through just such organization as we are discussing.

MR. BRITTON—I would state to the members that the forms referred to by Mr. Martin are on my desk, and are for your inspection, and will be for your help, I am sure, if you will look them over at your leisure. It seems to me that Mr. Martin did not show a proper appreciation of the training that has builded him up into the systematic and consolidated man that he is;—and we know from his personal appearance that he is very much consolidated. (Laughter.) He came into the Gas Association a stranger in our midst, knowing nothing about gas, except that, from his personal experience, it was expensive to use; and he has heard the members of the Association from that time on preach the things that he has set forth so ably in his paper. I know from my knowledge of the man and the intent of the paper that it was no reflection upon the conduct of the larger companies on the coast. He spoke of what he saw in his investigation of the smaller gas companies throughout the State. They needed attention badly. They needed consolidation to make money. I do not think there was more than one in the State that was paying dividends even upon its earnings, to say nothing of its capitalization; and it needed some strong, active man with liberal ideas, and with the education given to him by his alma mater, the Pacific Coast Gas Association, to help these companies out of the slough of coal tar and ashes and dirt into which they had fallen. He has done it and done it well. The smaller gas companies have been put upon their feet and they have plate glass windows and accommodating managers to attract the consumer, who is always represented in towns of that size by the female sex. I think the lesson is one that ought to be learned by everyone here who represents a gas company. He can take Mr. Martin's word for it, or if he doubts it he can come and see for himself that, as Mr. Jones has said, cleanliness comes before profit, and that the profit comes and comes fast and quick if you start it by that sort of method. And our Eastern representatives (I notice Mr. Kahn and Mr. Roper and Mr. Doherty with us) can go back to the Atlantic coast and take the lesson to the people there of the necessity for maintaining gas works in good condition and of the education along the line of consolidation that has been provided by Mr. Martin from years of experience. That is one of the things the Pacific Coast Gas Association has done; it has educated more men along the lines of the proper running of gas works, proper attention to consumers, and the proper treatment of consumers than any other gas association I know of in the world, because it has come down to a practical standpoint; it doesn't theorize and it doesn't read papers at length on subjects that are talked over the heads of the average member; it has been a practical educator. And that is our aim, and it is going to be our aim to keep it so for all time, to educate the little man, as he feels himself to be in a little works, to feel that he is just as big as the biggest man at the biggest works.

MR. PARKER—I was present at the first meeting and listened to the dissertation of Mr. Meyer, but I did not receive quite the impression that Mr. Martin did. Speaking from my own standpipe — standpoint — I endeavored to introduce Welsbachs into Napa, but I was unable to, though I wrote to the parent office asking how I could either beg, borrow or steal some lamps. I think some of the works on the coast did pay particular attention to making their works presentable and also to voluntarily reducing the price of gas; but in small towns it was a long time in developing. In some of the little valleys there was no chance for extensions. But this idea of consolidating interests has shown itself to be a success.

MR. BRITTON—I do not think the statement of Mr. Parker from his "standpipe" ought to be corrected, for the reason that he has always been a pure and simple coal gas man and nothing else. He realizes it. (Laughter.)

MR. MARTIN—My reference to the "foul-smelling gas works" was applicable to a number of the plants which we purchased, and was the condition prevailing in small gas plants throughout the State. In fact, the paper which I read referred only to the smaller gas companies, no application being made to the larger ones which were selling gas at lower prices. The impression in regard to Welsbachs made upon my mind at the first meeting was that the members were discussing how it would be possible to even pay wages if everybody could use them. I do not know if Mr. Parker was among the number, but there were a number of the managers of the smaller gas companies who were doubtful about introducing Welsbachs. It was merely my thought to indicate to the members generally the change of conditions in this Association. We think about different things today. We try to benefit our employers and at the same time very largely benefit the public; the two must go hand in hand to be successful.

MR. PARKER—I remember one remark made by Mr. Osborne, that we all understood how to make gas, but the idea of coming to the Association meetings was to try to find out how to sell it.

MR. LOWE—I merely rise to move a vote of thanks to Mr. Martin for his excellent paper. I regret very much indeed that the discussion has not been more extensive. The reason is we all agree heartily with what Mr. Martin has said. (Carried.)

THE PRESIDENT—I will appoint one committee (the balance of the committees will be appointed this afternoon), and that will be the Nominating Committee: Mr. E. C. Jones, Mr. H. C. Keyes and Mr. T. R. Parker.

The meeting was then adjourned until 2 P. M.

FIRST DAY.—AFTERNOON SESSION.

The meeting was convened at 2:05 P. M.

The Secretary read a communication from the Mechanics Institute.

Mr. E. C. Jones then presented his paper on "Pressure Points."*

THE PRESIDENT—This is another of the many practical and valuable papers with which this Association has been favored from time to time by Mr. Jones. I will call on Mr. Colquhoun to open the discussion.

MR. COLQUHOUN—This subject has been very well covered in Mr. Jones's paper. We have, as Mr. Jones has said, a system that is different from any other in use. We are serving about 300

* THE JOURNAL, August, 1904, page 301.

consumers from our high pressure mains and also boosting up our low pressure mains. The experience we have had is ideal. The consumers are very much better served and much better pleased. The only trouble we have had at all is that the consumers have had too much gas. I think that one should look out for grading his pipes. We have had some water for some cause or another. If we had not graded the pipes, I think we should have had more or less trouble. Ours are graded in the same way as low pressure pipes, though perhaps not quite so much. We have also had to put in drips about a thousand feet from our compressor to catch any condensation. There is no trouble beyond if it is taken out there. Another thing to be taken care of is to put a safety pipe on each governor in case of a break, so as not to extend the pressure beyond the meter. Otherwise it is an ideal system.

MR. BRITTON—This paper is largely educational. I imagine most of the gas men have had no experience in high pressure distribution systems, and questions may enter their minds as to its applicability to any low pressure system. Perhaps it might be just as well to say right here some little things Mr. Jones has purposely omitted for fear of making the paper too long. The high pressure system in any phase (even calling a pound or a pound and a half high pressure, as against what would be commonly regarded as such) can be used at any time for the building up of low pressure mains anywhere, either by a trunk line of high pressure feeding into the low pressure, or by pumping directly into the mains to the extent that they will stand it. I presume some mains would not stand over a pound or two pounds without enormous loss by leakage; but a majority of the cast iron mains will stand up to eight or ten pounds without serious loss. There is one factor in connection with distribution by high pressure and that is the absolute necessity of providing pipes at the intake and outlet of the compressor of large enough size to take care of the surge that will sometimes occur. If your outlet pipe was three inches and your inlet three inches, you could not draw to the extent of the capacity of your compressor. I would like to ask Mr. Colquhoun what his experience in that respect has been,—what he found it necessary to do as to the inlet and outlet pipes.

MR. COLQUHOUN—When we first connected we had a 4-inch inlet. It was not very satisfactory. Afterwards we put in a large steel cylinder, 42 inches in diameter and 22 feet long, and connected directly from the outlet of the holder to the cylinder. A small pipe is not good. I do not think you can get too large an inlet pipe.

THE PRESIDENT—We should like to hear from Mr. Grover.

MR. GROVER—I think you are rather imprudent in calling on me, for I have not had much experience in this line. High pressure was new to me when I came from the East, but I have had an opportunity of examining all the systems Mr. Jones spoke of in his paper. The most interesting point to me about it is the practicability of running a gas compressor with a gas engine, that I think should be strongly brought out. We made some observations as to the amount of gas necessary to compress a given quantity and found that about ten per cent of the amount of gas compressed is required for the gas engine. Most of these observations were made on the gas engine at Grass Valley, which is operated at an elevation of over 2,000 feet. Gas engine builders declare that a rise of a thousand feet destroys the efficiency about five per cent. In other words, we should be losing about ten per cent of the efficiency of this gas engine. When I was last in Grass Valley we made a trial on the compression tanks there and succeeded without any difficulty at all in running the pressure up to 100 pounds with this gas engine, and the rating of the gas engine is very close to the factor of safety for the compressor. The compressor, according to the builders, requires every bit of the horse-power that the gas engine is rated at.

MR. LOWE—For what pressure is the compressor built? Will it do more than 100?

MR. GROVER—I did not try to run it any higher than that.

MR. JONES—It is an 80-pound compressor.

Mr. LOWE. Were you then using all the power of your engine?

MR. GROVER—I think we were.

MR. LOWE—What is the horse-power of your engine?

MR. GROVER—It is rated at 38.

MR. LOWE—And how rapidly were you compressing your gas?

MR. GROVER—I can not tell you that. I have a number of observations I made, but I have not the results worked out in a form to give that.

MR. JONES—I think Mr. Grover has been altogether too modest in his explanation of his experience with high pressure. If he cared to tell the members what he did last winter in keeping up the pressure in Oakland, I think it would be interesting. He staid with it night and day.

MR. HOLBERTON—Have you ever tried a direct-acting compressor?

MR. JONES—We have not tried direct-acting compressors because there has been some difficulty on the part of the compressor builders to secure quick operation of the valves. They found it difficult to get a valve that would operate quickly enough to coincide with the speed of the gas engines. Gas engines of small units must of necessity run rapidly so that the speed of gas engines heretofore has been too great to successfully operate gas compressors. But that has been successfully overcome by changes in the valves of the gas compressors. I have recently seen a valve designed by one of the Eastern builders which I think will obviate some of the troubles of speed.

MR. PENNOYER—Would it not be more economical where a gas works has an excess of residuals to use a steam-driven compressor? I note that Mr. Grover says that it takes 10 per cent of the amount of gas compressed to operate the gas engine. If we have about our works enough residuals to operate the entire steam portion of our gas works and also have enough residuals to operate a steam engine to drive this compressor, we would not have that loss of 10 per cent.

MR. MILLER—In Los Angeles we have driven compressors with a loss of only about 3 per cent, or taking about 3 per cent of the gas compressed. Ten per cent I should say would be very excessive.

MR. LOWE—Do you use your gas engine in pumping from Los Angeles to Pasadena?

MR. MILLER—We have, but we use electric power now.

MR. LOWE—I know where gas engines are used in the natural gas fields, and my understanding is that they use about 4 per cent to 4½ per cent in the gas engine of the amount of gas compressed in raising it to several hundred pounds pressure. It strikes me that 10 per cent is very high. I would say that I know of a gas works in which a direct-acting compressor is being used and is working very satisfactorily. I know the company has just purchased a second compressor, but as to the practical results I can not tell you.

THE PRESIDENT—Perhaps Mr. Holberton can tell us something about the use of electric power.

MR. HOLBERTON—I do not know that I can give you very much information. I know that they are operating certain gas apparatus in Oakland by motors. As far as I know it is perfectly satisfactory. Mr. Jones's greatest care is to see that the current does not give out. The bulk of their apparatus in Oakland is operated from storage batteries, so that I do not think they have ever had that particular trouble, but that would be the case in smaller works without storage.

THE PRESIDENT—We should like to hear from Mr. Stirling.

MR. STIRLING—I am a novice in the gas business, having just joined the Association, but I agree with Holberton that you should have two sources of power in a plant of that kind. Electric power I think would be cheaper than using 10 per cent of the gas to compress the gas. But I understand from Mr. Grover that the inefficiency was due to the altitude and that it would not occur in a lower altitude.

MR. MILLER—I think there is another reason. I think 100 pounds is too high. Mr. F. H. Shelton, who is an authority on the subject, has put himself on record that from 20 to 25 pounds is the highest economical working pressure. If you are running works sending out 300,000 or 400,000 feet an hour high pressure will not pay.

MR. PEDERSEN—I should like to know what trouble Mr. Colquhoun had with his governors. And as to pipe: There are soils, of course, where steel pipe is not the best thing. I noticed in the rear of the hall today some connections of pipe with machine joints. Could that be used with high pressure, and if not, why?

THE PRESIDENT—I think that possibly Mr. Gutsch could tell us something about governors.

MR. GUTSCH—The governors check absolutely any damage to the meter and prevent trouble in the house by fluctuation. There have been a good many governors designed. I believe most of them are not automatically closing in case of accident nor are they adaptable where the pressure changes, particularly where the compressor works only part of the time and where the compression is a thing that has to be regulated. I believe Mr. Lowe has set up a private concern in Pasadena to study governors.

A MEMBER—We have aimed to get a governor that would be self-closing under high pressures and one that would also regulate fluctuations as high as from 100 pounds, if necessary, down to 3-10 inch. This governor is something new, and while it has been tried exclusively in one town with so far very good results, we do not know yet whether it would work under other conditions, and should like to wait until we know more about it. I know a man in Los Angeles who has designed another governor for the same purpose, and from what he has told me, he can regulate down to 1-10 inch. A governor is certainly an important feature in high pressure.

MR. WEBER—We have had some experience with high pressure. We have individual governors, as Mr. Jones stated in his paper. So far we have not had a single diaphragm give out, and we have in the neighborhood of 500 installed. These governors are excellent, provided we have one percentage more on the high pressure end than on the low. They are set so as to give about four inches water pressure at each outlet. We have no storage tanks at our end and have very little trouble in maintaining our pressure in town. It has gone low, but not low enough to do any great damage. Once in a while we have had low pressure, when a stove burns about half what it should burn, but it has not gone entirely out at any time. The workmanship of laying pipe should be first class. If you have had your mains under three or four inches water pressure and then apply 25 pounds pressure, the leakage will often be many times what it was with low pressure. Any man attempting to put in a high pressure gas main, should use nothing but the very best fittings and pipe and should not crowd his men as to getting the work done. He should see that all the work done is done well, because the loss from leakage will continue as long as the pipe is in use. I believe that high pressure should not materially exceed about 25 pounds. An extra horse-power is required, too, to force the pressure higher, and power is expensive. Storage tanks should also be provided in case of temporary shut-downs. The expense of storage tanks is, I understand, very nominal, compared with their importance. I think that no man should pay more attention to any part of his business than the gas man to his tanks.

MR. LOWE—Did you say that you had one governor diaphragm fail?

MR. WEBER—Not one.

MR. LOWE—Mr. Colquhoun, did you say some of the diaphragms failed?

MR. COLQUHOUN—No. I had one governor break. It exploded; but that was owing to the carelessness of the man. I think it will be only a short time until all gas companies increase their pressure somewhat.

MR. HOLBERTON—Mr. Jones tells us in the paper that they have prepared a table showing the pressures to be carried at different times of the day. I would like to ask if they have ever tried any automatic means of maintaining a pressure which would increase with the flow of gas, doing it automatically. In other words, it seems to me that the speed of the compression is a function of the amount of gas that is being used. I believe it would be feasible to construct a compressor that would take care of that. The more gas being delivered, the faster the compressor would run.

MR. JONES—The ordinary automatic district governor now in use will accomplish that work if it is put at the Petaluma end.

MR. HOLBERTON—I mean something placed at the compressor to regulate the speed of the compressor according to the body of gas being used.

MR. JONES—That can only be done where there is no intervening pressure tank. It is the best practice to have compression tanks and raise the pressure in the tanks and then use automatic regulators from the compression tanks.

MR. HOLBERTON—I would suggest doing more than that. Maintain a gradual pressure on the tank and at the other end you have a gradual consumption. Loss of pressure in the pipes must necessarily depend to a certain extent on the amount of pressure flowing through. The initial pressure should be gradual.

MR. COLQUHOUN—There is a device similar to that. I know we have one with the last compressor.

MR. HOLBERTON—You mean it operates to maintain a constant pressure. I want to maintain an increasing pressure as the consumption increases.

MR. LOWE—Mr. Pedersen raises a question as to the use of cast iron pipes. There is no objection to the use of cast iron pipe so far as the method itself is concerned; but if there is any particular advantage to be derived from high pressure delivery it is in the lower cost of street mains. If you use small pipe a cast iron pipe becomes nothing more or less than a pipe stem and is broken very readily. At one time cast iron pipes were used for service pipes, but they were very glad to adopt wrought iron for services because of the fact that it did away with the breakage of the very small cast iron pipes. I think you all know two-inch street mains were formerly laid with cast iron pipe, and the use was discontinued because of the fact that they broke so very readily. For the same reason I would be afraid to use cast iron pipe on high pressure work. In addition to that the cast iron pipe can never be as smooth on its interior surface, and the rougher the pipe, the greater the obstruction of the flow of gas.

MR. PEDERSEN—Is there not more leakage in cast iron pipe?

MR. LOWE—The question of sand holes is of minor importance. It is true that the porosity is very much greater, and if you were to get into very high pressures, you would lose a great deal more through the pores. But I do not think that question would arise in ordinary commercial gas delivery under high pressure.

MR. JONES—In regard to the statement of Mr. Grover that in compressing he uses 10 per cent of the gas compressed, he had reference to a small engine where the efficiency was probably two and a half times less than would be obtained in modern gas engines; and I am not quite sure that the altitude does not effect the operation of the engine. Surely it would effect it to the extent of about 9 per cent less efficiency at 2,500 feet elevation. By the use of oil under boilers for compressing gas it can be done with less than one gallon of oil per thousand cubic feet. We have never had any stated experience with the operation of large units of gas engines or large compressors, so that I would not like to have that statement go out as applying to gas compression where it is operated by gas engines. I believe there is no more economical source of power than the gas engine. I am a firm believer in both the present and the future of the gas engine for all purposes. Mr. Miller's statement in regard to the pressure on mains advised by Mr. Shelton not exceeding 20 pounds to the square inch is corroborative of the statements in my paper. I believe we ought to study how low a pressure we can carry rather than how high a pressure we can carry. When you are discussing this subject, you begin to mix up inches and pounds. When you are talking about a quarter of a pound pressure, you are talking about twice as high a pressure as you are carrying on your mains under low pressure. Mr. Weber's statement means that he has 100 per cent overload on his mains to overcome and provide four inches of water pressure on the house pipe. Another point that should be considered is that the compression tanks act as storage holders, and I firmly believe that

working these compressors up to the economical limit of 80 pounds to the square inch into these compression tanks is the best practice. Then cut your street main pressure down to any point desired. Another matter: In handling governors, as brought out by Mr. Gutsch, every high pressure governor should have a sufficient valve opening so that, should the pressure go off entirely, there will be a supply of gas to the consumer. It would be a calamity if the pressure should go off entirely when the bath room lights and other similar lights were burning at night. But the governors now in use have ample valve openings, and the valve itself is fastened by a joint to the lever connected with the diaphragm which operates the valve, so that if the pressure goes off the line the diaphragm drops and the valve is lifted and permits enough gas to pass through to keep the gas burning. I have found that an ordinary No. 1 Equitable governor will furnish 100 feet of gas per hour through these openings at 4-inch pressure. In regard to automatic compression, we have several good governors that will operate automatically. The Fulton governor, for example, will so operate,—that is, should the gas be shut off by any accident, the governor will close and has to be reopened by hand.

MR. LOWE—It may not be amiss to say a word about the construction of pressure tanks. Last year in advocating pressure tanks, I stated that a tank about 30 feet by 4 feet 6 inches and made of $^{9}/_{16}$-inch steel would have a safety factor of four if operated at about 75 pounds pressure. Experience has shown that they can not be caulked sufficiently tight to keep in the gas, and tank builders now admit it. The experience has been that it requires at least quarter-inch metal to permit of caulking sufficient to ensure a tight job by reason of the fact that the thinner sheets are not uniform in thickness and do not provide a sufficient amount of metal to allow for a tight joint. Therefore it is safe to say that even on small compression tanks you should use metal not lighter than quarter-inch, and when so made they are guaranteed tight at 150 pounds gas pressure.

MR. PENNOYER—What is the smallest sized pipe you would advise to be used in a high-pressure distributing system for mains?

MR. JONES—In the last two years I have changed my ideas in regard to the size of pipe. When the high pressure system in Fresno was laid out I used 1-inch, 1¼-inch, 1½-inch and nothing larger than 2-inch pipe. If I were to lay out an ideal system now, I would use nothing less than two-inch pipe for main pipe and couplers, as described in my paper, and half-inch service pipes.

MR. PENNOYER—How would you connect the service pipe?

MR. JONES—It could be done very safely and well by using any of the heavy saddles made for that purpose. Use lead gasket between the pipe and the saddle. A stop-cock should be screwed into the saddle. Drill the hole through the opening of the stop-cock, after removing the drill there is no loss of gas, no danger to your employees, and the hole that is drilled even with a ⅜-inch drill is amply large.

MR. PENNOYER—I think Mr. Jones is entitled to the thanks of the Association for this very instructive paper, and I wish to make such a motion. (Carried.)

THE PRESIDENT—The next paper is one by Mr. T. R. Parker, one of the past-presidents of the Association, who will speak to you on "Auld Lang Syne," in other words, the gas history of the Pacific Coast.*

THE PRESIDENT—I think that what Mr. Parker has not related of the history of the Pacific Coast gas companies is not worth relating. Is there anyone present who desires to offer anything on the paper?

MR. LOWE—Is is a very much easier matter for us, Gentlemen, to sit and listen to this paper than for Mr. Parker to prepare it. It deals, of course, with dry facts that are not particularly interesting to us at present, unless you look at it all from this standpoint: That we are all of us now resorting to our libraries for the purpose of ascertaining something of the early history of the gas business fifty, seventy-five and a hundred years ago; and the time will come when the information given us today by Brother Parker will be just as valuable as that information we are now seeking in the past. The paper is a long one, but it is not sufficiently long, because of the fact that it has dealt with only a very few of the gas companies on the Pacific Coast. There is probably nothing of greater interest to such an association as ours than a historical record of the past of the gas business. It has been considered a very excellent thing to have an association historian, and that matter has been discussed from time to time, with the result that we should appoint an historian who can, little by little, each year add to the records of the past. I think the work should be taken up where Brother Parker has left off. The papers from year to year would be very short, because containing only the happenings of the current year. I am sure we owe Brother Parker a hearty vote of thanks for the work he has done. Personally, I am sorry it was not complete, dealing with the entire coast, but, of course, if that were the case, it would cover one of our entire volumes. I move a hearty vote of thanks to Mr. Parker for his timely paper. (Carried.)

MR. LOWE—I would like on this question to offer a resolution that the Association include a historical department, and that Mr. George P. Low, who has consented to act as the historian of the Association in the future, be appointed to fill that position.

THE PRESIDENT—I do not believe any one will doubt the importance of the position which we are about to introduce into this Association. I have very much pleasure in putting the motion that Mr. George P. Low be appointed historian. (Carried.)

THE PRESIDENT—Before we proceed to the next paper I will read the list of committees. The Advisory Board and the Committees on Library, Wrinkles, Experiences and Novelties will be continued during the coming year by the same gentlemen who have so admirably officiated during the past year.

I now have the pleasure in calling on Mr. C. H. Pennoyer, who will now read his paper on "Effective Steam Plants for Gas Manufacture."*

MR. JONES—I have been very much interested in Mr. Pennoyer's paper, and I can see that when a man is adopted into our gas family he assimilates very quickly, and by spending time in the gas works, as Mr. Pennoyer has in San Jose, he has come in touch with a great many truths, and I am glad to know he has kept his eyes open. The use of lampblack as boiler fuel, of course, is general among our plants. We have learned the value of lampblack. We do not consider it for a moment as a waste product. It may be of interest to you to know that out of the lampblack residual of our oil gas making we have succeeded in making a very excellent oil coke. It contains 98.8 per cent of fixed carbon. This coke was first made experimentally, but we are now constructing a system of coke ovens embodying modern ideas, and we hope to have the coke ovens in operation at the Oakland plant in a few weeks. Everyone of our boilers fed by lampblack is giving excellent satisfaction. At first we had some trouble with the melting down of the cast iron bars; but with wrought iron bars we have obviated the difficulty. In regard to the use of lampblack as a non-conductor, I am pleased to see that Mr. Pennoyer has taken up Professor A. Ordway's figures. Those figures are quite old, yet they are all true. The paper is many years old, and it should have been republished. It is now out of print. I remember one time in the East trying experiments with the insulation of some steam pipes where I was obliged to carry steam across a street from a gas works boiler to a holder, which in the East was covered with a circular brick building. It was a source of a great deal of complaint that the heat escaping from the steam pipe melted the snow on the street. Upon digging up the steam pipe and boxing it and filling the boxing with lampblack (I was obliged to buy it from an ink manufacturer) I found that the snow never melted where the pipe was so protected, proving that lampblack is the best non-conductor we ever had. At that time I did not think it possible that it would become a by-product of our method of gas manufacture.

* THE JOURNAL, August, 1904, page 287.

* THE JOURNAL, August, 1904, page 317.

MR. HOLLIDGE—I would like to ask Mr. Pennoyer what was the location of his mud drum.

MR. PENNOYER—It is located above the first fire doors. In the semi-marine type the tubes incline towards the front and the mud drum is located at that point. The steam and water drum is at right angles with the tubes.

MR. HOLLIDGE—Do you not think that the water of the section should be tested in order to know what is necessary for your boilers.

MR. PENNOYER—Certainly it should be. The waters of a locality differ very materially. We are using one sort of compound at the electric light works, and at the gas works, half a mile distant, a very different compound.

MR. HILL—I would like to ask a question in regard to the making of coke out of lampblack,—just how long it takes to make the coke out of the lampblack, and some idea of how to proceed.

MR. LOWE—As to how to make coke from lampblack, I will say: Lampblack may be considered as being as pure a coke as we can have. Lampblack is a carbon in a state of very fine subdivision, and if coke is to be made from same, all that you can do is to take the particles and combine them so that they will be retained in commercial form. It would at this time take too long to go into details of the method of so doing.

MR. JONES—I was about to reply to Mr. Hill's question. As Mr. Lowe has truly said, lampblack is an ideal coke in itself. It is devoid of all volatile matter as lampblack, but as we get it out of our sets it contains enough tarry matter to bind it and properly coke it, so that even in a coal gas retort there is enough heat to fuse the material into a perfect coke and a coke sufficiently hard for use for metallurgical purposes. Our experience in Oakland was with the coking of lampblack in ordinary retorts, and we found that it could be done so successfully and produce an ideal open grate fuel,—a fancy domestic fuel, that we propose to make it commercially. If you take coke made from lampblack and its binding material, which contains less than 1½ per cent of ash and is easily ignited, and place this coke upon an open grate, with very little kindling and without any blower to induce a draught, the lampblack coke will glow and burn until it is entirely consumed, with very little ash under the grate after it has been burned. The amount of ash (less than 1½ per cent) is extremely small, so that with one hundred pounds of fuel the ash would be less than 1½ pounds. It has the extra advantage as a fuel of being so nearly pure carbon that the fire never goes out, once it is kindled. The reason for a coal fire going out is that as the carbon burns on the surface (which consists of carbon and earth ash) after the carbon has come into contact with the oxygen of the air the fuel becomes coated with ash and the oxygen of the air can no longer get to the carbon to oxidize it; therefore the fire goes out. But in the case of lampblack coke there is always fresh carbon presented to the oxygen of the air, so that combustion takes place and is continued until all the fuel is consumed.

Twenty-four hours in an ordinary retort will produce a good hard coke. But these figures I am giving you are experimental figures, and the figures were obtained in the making of coke in an extravagant manner. That is, in order to make coke properly from your lampblack, it should be made in a coke oven designed for the purpose.

MR. HILL—I do not want to take up the time of the Association unduly, but what prompted my question was that I realize that there are a great many small plants that have a by-product in the shape of lampblack. At our plant we make more lampblack than we can possibly consume under our boilers for making the steam necessary to run our gas plant; and the result is that we have a quantity of lampblack that we do not know what to do with. We do not run 24 hours. We have a coking device on our machine, and we can fill it up and run for three and a half hours and make all the gas we want. During that time we can not make coke.

MR. JONES—There is a point in the size of small oil gas sets where more oil lampblack is made than is necessary to make steam. This is the case in works about the size of that in Marysville. Marysville is an ideal plant, and the man who is running it deserves a great deal of credit. His excess lampblack he sells to the woolen mills. They use it as fuel under their boilers. In the case of a plant which has a small amount of lampblack left over, it might be well to spread the lampblack out and partially dry it. It gives out its moisture rapidly and cakes readily so that it becomes a clear fuel. At present we are selling lampblack piled up and partly dried to our electric light department for running their boilers. Mr. Holberton has charge of that department and I think can tell you something about it.

MR. LOWE—If you run an electric light plant, Mr. Hill, why don't you save up your lampblack and fire your electric light plant with it?

MR. HILL—The trouble is that we can not make steam enough by firing with lampblack. We have to force our boilers along partially with oil in order to carry the load.

MR. LOWE—At Hollister they do not make a sufficient amount of lampblack to fire their boiler alone. They run their gas works from their electric light boiler, and they would have to wait a long time to get enough to run their electric light plant; therefore they sell their lampblack to the farmers in the vicinity. You could do the same thing.

MR. HOLBERTON—We have the same difficulty Mr. Hill speaks of. We could not use lampblack under our boilers at all times. We have to keep steam twenty-four hours a day and use lampblack when the load is light. At night under the other boilers we use oil.

MR. JONES—Do you attribute that to the amount of water in the lampblack?

MR. HOLBERTON—You could probably build a boiler with a special setting to generate the proper amount of steam.

MR. PEDERSEN—We have a number of plants in the State, and none of them can make lampblack enough to entirely supply the boiler for steam purposes. We put an oil burner in and make a bed of the lampblack and feed in oil at the same time,—just enough to furnish the capacity required in the boiler. It worked very well in every instance. We never have any lampblack to dispose of, and use oil at the same time. I think that you could work in oil on the electric proposition where you have to have plenty of steam.

MR. PENNOYER—It might not need so much oil if the lampblack was allowed to accumulate and dry. Then fire the lampblack straight, and then go to your oil.

MR. HOLLIDGE—What did the farmers around Hollister use the lampblack for?

MR. LOWE—For firing steam plants and pumping plants in the valley.

MR. PENNOYER—You would not suggest taking the lampblack as it comes from the lampblack box with 60 per cent of moisture and throwing it into the furnace?

MR. LOWE—No, decidedly not. I wish to move a vote of thanks to Mr. Pennoyer for the able paper we have heard. (Carried.)

Mr. George S. Colquhoun then presented his paper on "Wrinkles."*

MR. MARTIN—I am sorry Mr. Jones treated No. 5 as a wrinkle. I think it was of enough importance to have treated it as a paper. He is hiding his light under a bushel.

MR. VALENTINE—I understand that in Oakland they are using an electric motor for driving the fan. Now I want to inquire what is going to happen if the current fails and everybody goes and starts their gas all over town.

MR. JONES—What are you going to do in Sacramento?

MR. VALENTINE—I am going to do the same thing and then have a gas engine.

MR. DOHERTY—It might interest you to know that in Denver there is the same arrangement with an electric motor, and that we intend to install both.

On motion of Mr. Martin a hearty vote of thanks was extended to Mr. Colquhoun for his labors in the Wrinkle Department.

The session was then adjourned until Wednesday at 10 A. M.

* THE JOURNAL, August, 1904, page 298.

SECOND DAY.—MORNING SESSION.

The convention was called to order by President Aldrich at 10:15 A. M.

MR. BRITTON—Following the resolutions adopted by the Association yesterday in the matter of the resignation of Mr. Grimwood as Secretary, I feel that there is something more due him than mere words of thanks to express the appreciation of the Association for the work that he did, covering a period of five meetings or four years. I think we can very well afford to show that appreciation by giving him some substantial token of our feeling for him as a member of the Association, and as one of our most earnest workers. I therefore move you that a committee of three be appointed by the Chair to select some suitable testimonial to be presented to Mr. Grimwood as a token of our esteem and appreciation.

THE PRESIDENT—I think, gentlemen, if any one should have the honor of seconding such a motion, it should be the president, because it takes the executive of this Association to properly appreciate the ceaseless work necessary on the part of your secretary in order to perfom the duties of what I consider a most important office. During the time that Mr. J. B. Grimwood has occupied the position of Secretary-Treasurer, and more particularly during my term of office, I have been brought into close association with that young man, and I know that there is not one among us who is more endowed with the true spirit of fraternity or with the love of his profession than is Mr. Grimwood. I am sure one of the most disappointing incidents in his career will be the fact that his failing health necessitated his resignation, and, still more, that he was prevented by that failing health from being present on this occasion. It is not usually the province of your president to make any remarks, but I felt called upon to speak as president, on the great services rendered us by Mr. Grimwood.

The motion was unanimously carried and the president appointed Mr. John A. Britton, Mr. L. P. Lowe and Mr. C. H. Pennoyer as the committee.

THE PRESIDENT—We will first hear a paper on the Labor Problem, by Mr. F. J. Symmes. I have very much pleasure in introducing to you Mr. F. J. Symmes of San Francisco, who takes a very great and active interest in our proceedings.

MR. SYMMES—Mr. President and members of the Gas Association, when our admirable secretary sent out the notice on a postal card that I was to speak to you on "Labor" he did not carry with that concise expression of his a full explanation of the title of the subject given to me. The mere word "labor" gives no indication whether it is male or female, black or white, Chinese or union. But in the notice which was given to me I was asked to say something on the labor problem, a problem which is, I believe, the greatest and most important one before our country today. It certainly can not be dealt with very completely in fifteen or twenty minutes. However, what I have been able to prepare for the occasion I will submit to you.*

THE PRESIDENT—Gentlemen, Mr. Symmes, in his usual complete manner has hit the nail on the head. As he rightly observes, we are lacking in moral courage in the conduct of our business. But this is a large subject and covers a large ground; and there may be a diversity of opinion. There is one gentleman here who yesterday told me he believed in the union and in having union gas companies. We want to hear from that man, and we want to hear from everybody who has something pro or con to offer on this most important subject, a subject that is dominating the mind of every thinker throughout the country. We should like to hear from Mr. Kahn.

MR. KAHN—It has been well said, Mr. Chairman, by yourself and by the gentleman who delivered this most admirable paper that the labor question, together with the consolidation question, with which it is so closely allied, occupies probably today the widest space in the thoughts of all good men, and, unfortunately, a great deal of time in the thoughts of a great many bad men. There is, no doubt, Mr. Chairman, that labor, as we are wont to consider and speak of it, is largely sinned against as well as sinning. All men who stand up and defend and urge the claims of labor are not bad citizens; they are not bad members of society; they are not enemies of capital; and they are not necessarily friends of the labor agitator. Now let me say to you, gentlemen, that when we study the labor question we must never lose sight of the fact that there are two sides to it, and two very large sides. We employers, we representatives of the capitalists, are very prone (as well we may be, inasmuch as we are human) to look at our side of the question and very rarely to look at the other side; and what is more, Mr. Chairman, some of us find it very difficult to look at the other side no matter how hard we try. It makes all the difference in the world between a man who has an income of $2,000 to depend upon and who has a certainty of getting his wages every day and the other fellow whose income is only $3 a day with no certainty that there will be employment next week; so that we will have gone far in solving the labor problem, in our own minds, at least, when we recognize that there is another side to it, and a very large other side. I have had the honor, Mr. Chairman, for sixteen years now to have been a member, and to have had a little to do with the organization of the National Stove Founders Defense Association. It was organized in the city of Cleveland, I think, in 1887. I did what little I could towards the organization of that body. I believe it was one of the earliest, if not the earliest, organizations of employers for the purpose of resisting the unreasonable and intolerable demands of labor of the kind that we employed. I think I am safe in saying to you, gentlemen, that until 1887, and beginning with 1872, there was not one year, there was scarcely one month when we in our works did not have a fight or strife of some kind to settle, and if we were able to make as much as five months of actual working days a year, we were doing very well. I speak of ourselves because our situation was very much akin to that of every other stove manufacturer. The stove moulders and the stove mounters were people with whom there was no getting along, and the Moulders' Union and the Stove Mounters' Union, to which they owed allegiance, were simply beyond all reason. Well, we organized ourselves into an association for the purpose of dealing exclusively with this labor question. About a year after we were organized we invited the International Moulders' Union to join with us once a year for two purposes; first, for the purpose of settling the wage scale, and next, for the purpose of determining under what conditions work would be done in our shops. They very gladly accepted our invitation; and since 1888 we have met annually and fixed our differences and adopted a wage scale; and I recall but one strike since that time in which the forces of our Association and the forces of their Association met in combat, and I need not tell you, gentlemen, that we licked them, horse, foot and dragoons,—cleaned them out,—and it was not a long fight either. We had a meeting a couple of months ago in Chicago where they resisted a reduction in wages. We felt that we needed a reduction very badly, and demanded fifteen per cent. (I speak of this only because I want to give you some idea of the spirit which moves us as manufacturers.) We wanted a reduction because we felt that the conditions demanded and required it. They did not want to concede it. And in view of their good conduct and good behavior in the past, we manufacturers, representing, as we did, a membership of over 150 firms with some $40,000,000 of actual capital, felt that we would concede their wishes and not insist upon the reduction. It was not made; and we are continuing to pay the same wages. It may have been a mistake. But they had behaved so well and been so loyal to their engagements and so faithful that we made no change. Now in the East some of our people adopted the union label on their goods. We in the West found that we were getting into a great deal of trouble with this union label because the workmen organized and got a great many people to ask for stoves with the union label. At the meeting this year we determined we would put an end to this union label. We said to them: "We have been meeting with you for fifteen years, and have got along peaceably. You have introduced an element of discord. You have shaken the red flag into the faces of your friends. You have got to stop. You have got to withdraw your label from the stove business. You can not

* THE JOURNAL, August, 1904, page 304.

meet us in amicable conference and then turn around and introduce this element of discord." We talked and argued over it for two days, and they decided that, so far as the stove industry is concerned, they would withdraw the union label. I think that matter is settled once and for all time. This is simply a practical statement of what may be accomplished when the employer and the employee meet together face to face, acting in absolute good faith, with perfect loyalty and with a mutual recognition of each other's rights. There is no trouble, gentlemen, under these conditions in getting along with ninety-nine out of one hundred laboring men. They are all good fellows. They all have big hearts in them. When you stop to consider the sacrifices that most of those men are willing to make,—that they do make in defense of what they believe to be their rights, you can not help taking off your hat to them and saying: "You are heroes." They are misled. They have not the business training that we business men have. Their horizon is narrow. If you will take these men into your confidence and discuss your difficulties with them from time to time and give them some idea of your own conditions, take my word for it, the majority of them will help you. Do not under any conditions, Mr. Chairman, hold the vast body of American workmen responsible for the faults of some of the bad laborers we have at the head of them. My statement would be simply this, Mr. Chairman: that all these years during which I have had personally a vast amount of experience convince me that there is one thing employers may do better than any other,—a simple thing—to straighten out this labor trouble. My observation has been that the chief defect in our system is that we take anybody and everybody into our shops. We give them any position in our shops that is considered merely as labor, whether it be as mechanic, or porter, or engineer, or anything else, and we ask absolutely no questions as to the man's past record. In other words, we keep hiring men and putting them in and asking nothing as to where they came from and what they did before. Now the employer with half a dozen people may do business in that way, or he may not. He probably does not. But you take the large manufacturer who employs from one hundred to a thousand men, or more, as some of us do, and when labor is scarce and he wants labor,—and even if he does not need it very badly,—he will hire anybody that comes along if he can mount a stove, or screw pipe, or do anything else, and ask no questions. I say to you that in my judgment that if the manufacturers in all lines of business would have an understanding, and if that understanding did not go beyond the mere fact that they would not hire a man unless when he comes along he is not only provided with his union card (I do not favor that. I do not say that that should be so. I speak of it only because a union man travels around with a card from the union to which he belongs, and before he has fairly put his foot into the shop and wants to know where his card is), but that when he goes to the employer in the shop, let the employer, on the part of the Association to which he belongs, ask for the card showing what shop the man came out of and that he is entitled to a certificate of good conduct. That is all you need. You have absolutely solved the labor question, so far as the employer is concerned. Offer a premium upon good conduct. You now not only offer no premium upon good conduct, but you offer a premium upon bad conduct, because there is no incentive for a man to be good, if he is prone to be bad,—and, unfortunately, most of us are bad rather than good. It is so with the working man. There is nothing immoral about such a requirement; there is nothing illegal about it. It is strictly within the spirit of the labor union itself. If a man comes into my shop I should find out where he worked before and whether he behaved himself. That is the labor problem in a nutshell. Offer a premium upon good conduct. Give employment only to those who are not disturbers, and you have solved the labor problem. As has been said by the previous speaker, you always have labor troubles when business is rushing, when the demand for labor is urgent. The labor question can not be solved by individual resistance. If you stand alone you can do nothing. If you are combined you may do something. But even that will not suffice. Profit sharing is only a makeshift. It has been only a temporary relief. It has not won out everywhere. It has been notably a failure in England. It did well in London. It was quite successful in Paris. The American Steel Company tried a little scheme a short time ago of having their men buy stocks, but that has been a failure. I think the United States Steel Company has been damned up hill and damned down hill on account of that thing more than anything that has occurred in connection with its history. It was supposed to be a selfish trick, and a great deal of ill-will is cherished against them because of it. Relief will have to come from somewhere else; and I believe the best possibilities for that relief exist in the spirit of consolidation, in the organization of consolidation, because the individual who has to fight his competitor and his labor as well is in bad shape; and consolidation can do a lot of things that the individual can not do.

THE PRESIDENT—Mr. Doherty, I have the pleasure of asking you for a few remarks. You took some part in the discussion at the Western Association of Mr. Shelton's paper, and I should like to hear from you.

MR. DOHERTY—Mr. President and gentlemen, the labor question is one that I have encountered in a great many cities and in a great many different situations. It is not a subject I feel able to talk upon. It puzzles me, and I have no solution to offer for the labor difficulty we all encounter. I have been spending a great deal of time in Colorado, and there has probably been no locality that has been afflicted with labor unions to a greater extent than the State of Colorado. They have had a constant turmoil there for fourteen years, and a great deal of hard feeling has been engendered. And while I think the employers will be successful in their present fight, I think it will be a victory with some serious drawbacks. It will leave scars. The contributor of this paper said much that interested me, but I do not know that I would care to defend all he said or criticise anything that he said. I feel that the most serious feature of organized labor is the attempt to curtail production. I do not look at high wages as in the least harmful to capital or to the capitalist. In fact, in our business, I believe we could be better off paying $5 a day for labor, if everybody else paid the same price. It makes more possibilities for our business. What is true of our business is true of other lines of business, but it can not be shown as plainly as it can be in the gas business. I think some organized effort should be made to change the policy of the unions. That will have to be done by persuasion. It must be pointed out to them that in trying to curtail production they are handicapping their own future and the future of the country, and that no one is benefitted. Another thing that has always appealed to me about the labor problem is the load factor, if I may speak of it as such. We all know we want to keep our plants running continuously. We can not afford to have a big peak at one time in the year and nothing to do at some other time. True economy requires an even load. I think it is the duty of every employer and of every labor union to try to find some method whereby all can be employed continuously. I sometimes think that the employer who does most for our progress is that employer whose minimum pay roll most nearly equals his maximum. In times of prosperity there is a demand for labor, and some manufacturer springs up with the ability to employ a great many men temporarily. He offers the men large wages and attracts them from stable lines of business which can run continuously at the wages formerly paid, but which can not make a living at the higher rate of wages. The result is that this manufacturer may be responsible for disturbing the whole labor condition, the economic condition of the country. I think the solution of the labor problem, perhaps, will be found to lie along scientific lines. The efforts we are now making are too fragmentary. They have no ultimate end in view. I believe the labor problem has never been properly or thoroughly treated. I have no very definite opinion, Mr. President, on the question as we generally discuss it. I may say that I have tried profit sharing. I have not found that it was a universal panacea. I have tried all sorts of methods of getting along peaceably with labor, both union and otherwise. I do not think that any of the undertakings with which I have been connected have had more than their share of trouble; but I have seen trouble crop out under

every possible condition,—where it was least expected. Last October I went to a strike in San Antonio, Texas, where we had conceded everything to our men for a number of years. We had done more for the progress of street railroad men than any other street railroad in the country. And yet the time came when we had to be a party to a very severe conflict. We had given up to them so long that they finally denied our right to exercise any authority whatever over the discharge of the men. They said that we could only discharge the men when the grievance committee of the union agreed that they should be discharged. It got to be a question whether we or the workmen were to control the property, and the inevitable conflict came. It resulted in a disastrous strike where cars were dynamited and tracks torn up.

MR. JONES—Mr. President and gentlemen, my experience with the labor problem has been as a mediator in the settling of differences between the companies which employed me and the men with whom I am associated; and it has been my endeavor to keep in touch with the men and try to understand the men, what they deserved, and what we could afford to do for them. And in keeping in touch with the men I keep also in sympathy with them, so that I really do not feel toward the laborer as many others do. In the gas business, as I am connected with it, we do not employ very many men in any one place; and the difficulty of settling labor disputes in our smaller works, compared with other manufactories, is like the taking of candle power,—it varies inversely as the square of the number of men employed. From time to time I have been called upon to settle differences, more or less important, concerning wages and hours, and in every instance I have been successful for the reason that I have gotten down to the level of the men; I have become one of them and have talked the matter over impartially; and I find the ordinary gas works employee very reasonable. The gas business is peculiar inasmuch as we are compelled to make gas throughout the twenty-four hours, and the demand for gas is erratic, and most gas companies are not provided with sufficient storage capacity to bridge them over many hours. Besides, the manufacturing apparatus installed is usually just about enough to supply the demand for gas. The labor difficulties have driven gas men to the construction of apparatus which will make a large amount of gas in a short time and to the installation of apparatus which requires very little labor to operate it. It will ultimately compel gas men to construct holders large enough to carry them over one day, so that the eight-hour problem will not be a serious problem to them. The men will be the losers. There will be fewer men employed, and the gas will be made in fewer hours and kept in store awaiting the demands of the consumer.

MR. LOWE—I want to move a very hearty vote of thanks. We are always very much pleased to hear from our friend Symmes, who helps us out occasionally—and when he does, it is very valuable contribution. Carried.

The report of the committee appointed to report on the President's Address was then read by the Secretary.

To the Members of the Pacific Coast Gas Association.

GENTLEMEN:

We, your special committee on the President's Address, beg to report thereon as follows:

In discussing this address, we may point out that this report may best take up the subject matter serially; that is in accordance with the sequence of the observations made in the address.

First, we recommend the appointment of a special committee to draft suitable resolutions upon the lamented death of the late Mr. Joseph Bryant Crockett.

Second, we recommend that the Secretary be instructed to express to Mr. J. B. Grimwood the thanks of this Association for his long period of faithful service; our sympathy in this time of his ill health, and our enduring hopes for his early and full recovery to the robust health which is his heritage.

Third, we concur most heartily in the words expressed by the President in commendation of Mr. John A. Britton's appointment to the Secretaryship of the Association—the position which he has, in years past, filled so ably and well, and we know that we do not exceed our authority in extending to him the cordial thanks of the Association for the self-sacrifice he has endured in its acceptance.

Fourth, the statistics presented in the address are interesting, gratifying and invaluable and cannot but be regarded with pride by every gas man. In fact it appears to the minds of your committee that the line of statistics so thoroughly inaugurated in this address could be followed up to the greatest advantage, in view of which we would respectfully recommend that this Association create the office of Statistician, and that the duties of this office for the first year be entrusted to the hands of the President.

Fifth, as to gas engines, they must be regarded as the most promising field for development—indeed, this development is of the literal today rather than of the figurative tomorrow, for with the perfection of single units of several thousand h. p. each, and their regular commercial operation in eastern and foreign localities, it seems that their ultilization in the Pacific Slope is only a matter of opportunity. This points to the conviction which we hold that before we can convince the public of their reliability and cheapness as power producers, we must demonstrate these facts in our own undertakings.

Sixth, we heartily concur in the opinions expressed in the section of the President's address pertaining to the Labor Question, but feel that the execution of the recommendation set forth therein, being open for discussion, cannot be carried out without first giving due consideration to paramount local conditions.

We have naught but words of commendation to express for the painstaking and untiring efforts that have been exerted by our retiring President, whose term of office has been characterized by an era of unprecedented progress, and to him the sincere and most grateful thanks are due.

Respectfully submitted,

C. H. PENNOYER,
Chairman.
W. F. BOARDMAN,
H. C. KEYES,
Committee.

On motion of Mr. Martin the report was received and its recommendations adopted.

Mr. P. W. Prutzman then presented his paper, "Notes Regarding California Petroleum."*

THE PRESIDENT—This splendid paper, gentlemen, is largely educational in its character, and we probably will assimilate it better when we reach our homes and have the published proceedings with us. However, we have with us this morning a distinguished guest in the person of Dr. C. F. Dean of the California Petroleum Miners' Association, and probably, Doctor, you would like to speak to us on this very excellent paper.

DR. DEAN—Mr. Chairman, I had no idea of making any remarks at all when I was invited here this morning by Mr. Jones, and I have really nothing to say, except to praise in the highest degree the paper you have heard read. Mr. Prutzman (who is the consulting chemist of our Association) we appreciate is one of the very best,—if not the very best—technical men in the refining and oil business in California; and these statements made in his paper I am sure are reliable. Although I see that his statement of the production of oil differs a little from mine, that arises from the fact that our Association is always most conservative in all its statements, as they are looked upon by all the officials throughout the governments, not only of America, but of Europe, almost as official papers. Consequently I am not a boomer in any way, and I think it a very bad thing to over-state the production when the true increase is large enough. When you take into consideration that we have increased from 4,000,000 to 25,000,000 barrels in four years, we are going far enough. I estimate that in 1904 we will produce 30,000,000 barrels of oil. The cause of the low price of oil is the old story of supply and demand. You hear it continually said that the Standard Oil Company is responsible for it. The Standard Oil Company has nothing to do with

* THE JOURNAL, August, 1904, page 306.

it at all, any more than this, that it buys its oil as cheap as it can. If it can buy oil at ten cents a barrel, it will buy it at that price; but if the supply is not sufficient, they will have to pay fifty cents, or whatever it may be. It can not make the price of oil. The amount of production makes the price. The fact of the matter is that we are producing more oil than we are using. If we had been put to it last year we could have produced 35,000,000 barrels just as easily as we produced 25,000,000 barrels. And we have today sufficient oil territory demonstrated and proved to produce easily 50,000,000 barrels of oil. It would be no trick at all for Kern River district to produce 25,000,000 or 30,000,000 barrels if they would sink enough wells. We know the depth of the sand and the quantity of oil there is in that district. The same thing is true of other districts. If the production continues to go on as it has, oil will not depreciate in value for some time. But if for any reason we should stop sinking wells, you would see oil jump very quickly. It is simply a matter of supply. The Standard Oil Company has nothing more to do with the price than you have. I am no particular friend of the Standard Oil Company, but if it had not been for the Standard Oil Company our oil interests in California would not have been nearly as vast as they are. They have invested in California over $15,000,000. Where would the money have come from for the pipe line and tanks and refinery if it had not come from them? We would not have had them, that is all. Just give the devil his due, and don't damn the Standard Oil Company for everything that goes wrong, for they don't deserve it. I thank you, Mr. President, for calling on me.

MR. JONES—I personally would like to pay a tribute to Mr. Prutzman as having been the writer of the best technical paper, by long odds, that has been presented to this Association for many years. The paper covers an immense amount of work. His figures are accurate, and he shows a great depth of understanding of his business; he has taken the first place in the State of California as a student of petroleum refining, which today is far more important to the State of California than all the gold ever found in its ground. This fuel is brought to us in clean tanks. It is delivered to us through openings in the sidewalks. It goes to our furnaces through pipes, and the amount consumed is controlled by a valve instead of by a saucy workman with a shovel in his hands. And the dirt of the coal and the dust and dirt of the ashes and the trouble of removing them are entirely done away with. Mr. Prutzman began the study of this subject several years ago, and I have had the pleasure of following him through his splendid work. He has certainly climbed to the very pinnacle of the proper understanding of oil conditions in California. The Association should be proud to have such a man as its member. And right here let me diverge a moment from the subject matter to say that I hope all our young members and all our new members will bring forward papers on technical subjects close to their hearts and teach us what they know. No matter if it is only presented in short papers of one page, let us have your valuable ideas. You are all having experiences. And the Pacific Coast Gas Association owes its present standing among gas associations to the work done by our members,—the work scattered among our members, rather than to the work of any one or two or three men. I would like to ask Mr. Prutzman a question in regard to California petroleum, and I know he can answer it if anybody can,—Is it possible that petroleum can be saponified, in the usual acceptation of the term of making it soap, by mixing with the petroleum itself any salts, similar to the ordinary soap making methods?

MR. PRUTZMAN—Strictly, no; but practically, yes. The heavier distillates from petroleum contain oxygens similar to the phenols. With a little water and with the heavy oil they will form very thick compounds resembling soaps in appearance, though scientifically they are not soaps at all.

MR. JONES—Would these products be classified as soaps?

MR. PRUTZMAN—They are simply mixtures. They would perform the same functions only to a slight extent. They will leave a greasy residue. They are not soluble in water. On dropping into water they spread.

MR. GUENTHER—I would like to ask about the average depths of the California oil wells.

MR. PRUTZMAN—The depths vary greatly. In the Santa Maria field there are some wells as deep as 3,000 feet. In Fullerton there is one well 3,700 feet deep. But this is extraordinary. The average well runs from 1,000 to 1,500 feet, and in some of the fields there are a number of wells not over 400 feet.

MR. WANZER—To what geological period does the oil formation belong?

MR. PRUTZMAN—It belongs to the Tertiary,—the middle Miocene. The oil is found in loose sands. The clays are water saturated, and the whole formation is soft and shifting, with very little rock formation anywhere.

MR. WANZER—What is the possibility of the oil supply diminishing in this State? I have been told that the probability is that in ten years the oil supply will begin to diminish.

MR. PRUTZMAN—Of course that would be largely a matter of opinion. There are no present indications of a falling off in the supply from any of the larger fields. Two or three of the small fields are about worked out. The yield of the Los Angeles field has very much diminished. The Kern River field is constantly increasing in actual production, though some people think it is really failing in producing capacity. That would be entirely a matter of individual judgment. Personally, I think there will be plenty of oil to meet the demand for at least ten years.

MR. BRITTON—In the discoveries of the last one or two years have any oils of a distinct paraffine base been found other than those known in Moody Gulch in the early oil days?

MR. PRUTZMAN—Not to my knowledge.

MR. LOWE—I would like to reply to the question in reference to the likelihood of the supply of oil diminishing so as to effect gas making methods by the use of oil. I think I am safe in saying that that will never occur because of the fact that the amount of oil used for gas manufacture is infinitesimally small as compared with the output. The large consumers of oil are the railroads and the fuel users in general. The price of oil, so far as California is concerned, is controlled by the enormous beds of coal in the State of Washington. The reason oil is so low just now is because with a slight rise in price the coals will come in competition with it, and as long as there is an enormous volume of oil the oils will be kept at a low price by reason of the threatened competition with coal. It does not make any difference to a gas manufacturer whether he pays a cent or two or three or four or five cents more per barrel for his oil. It makes very little difference per thousand cubic feet of gas. But very slight differences are vital with the fuel users, and a very few cents increase in cost per barrel of oil would bring coal into competition. There is, for a great many years, a supply of oil for gas making purposes, and the cost never can go, practically speaking, so high as to make it a question in the mind of a gas man as to whether he will have his supply, because he can always afford to pay more for the oil he needs than can any other user of oil.

MR. MARTIN—I should like to take issue with the statement made by the last speaker as regards the coal from Washington. The present low price of oil, as truly stated by Dr. Dean, is due to large production and comparatively limited demand. The low price is due to the competition of oil with oil. The ownership of the oil wells being so varied keeps down the price. If the entire fields were in the hands of one corporation they could increase the selling price at the wells fully thirty or forty cents a barrel before the oil would come into competition with coal from Washington or from any other section. However, an increase in price to that extent would not seriously affect the profits of gas manufacture. There is another fact in regard to the asphalt oils that might put a gas man's mind at rest as regards supply. After the sands have been pumped for a great length of time and the lighter oils have been extracted, there is left an oil of 10 or 12 gravity, or lower (in some sections as low as 9 or 8) which would be useless for the purpose of fuel but which gas apparatus can be designed to utilize. The extraction of some of this oil is effected, I believe, by endless ropes which are scraped as they come to the

surface. Even this can be used advantageously in gas making, so that the supply of oil in California is unlimited for the gas man.

On motion of Mr. Jones the thanks of the Association were extended to Mr. Prutzman for his valuable paper.

The meeting was then adjourned until 2 p. m.

SECOND DAY—AFTERNOON SESSION.

The session was convened at 2:15 p. m.

THE PRESIDENT—The Committee on Obituaries will consist of Messrs. Jones, Parker and Britton, three past-presidents.

The Secretary then read the report of the special committee on the President's special report on the St. Louis Gas Congress.

THE PRESIDENT—Mr. Doherty is the author of a very valuable paper on the whole question, and I feel it an honor to have him present at this convention. Mr. Doherty, we should like to hear from you.

MR. DOHERTY—Mr. President, I want to enter a little preliminary explanation first and correct an impression that may be in the minds of your members regarding the paper read at the Congress. The paper I read at the Congress was entitled "Association Work." It was a plea for better Association work, and, incidentally, a plea for consolidation; but the main plea was for better Association work. Now to turn to the plan of consolidation. That plan did not contemplate a reduction in the efficiency of any of the individual Associations, neither did it recommend the disbanding of any of the local Associations. I am sorry to take issue with your president and the gentleman who presided over the Congress so ably when I read my paper, but I think that for this Association to say we would not welcome a closer affiliation with other associations is on a par with the action of the gas man who does not belong to any association and tells you that his conditions are so peculiar and so unique that he has nothing to gain by Association membership. I have no doubt we will find Associations of that sort. They will say: "Our conditions are so peculiar that we have nothing to gain by affiliation or consolidation or closer relationship." Now those of the members of the Pacific Coast Gas Association who are interested in the subject I would ask to read my paper. It is a long paper, and perhaps tiresome, but the question seemed to demand that sort of treatment to make my meaning clear; and I doubt if anything short of reading that paper will make clear what I had in mind. But at the expense of repeating myself, I want to reiterate that my plea was solely for better and more effective Association work. Now a rough computation while I was sitting here this morning would lead me to believe that about $200,000 per year is spent for Association work,—in attending and conducting conventions. Now the question is, Are we getting a proper return for that $200,000? And I hold that a proper return would be nothing less than all that is possible. And I am quite sure that we are not getting all that is possible. The ideal Association would be that Association where each member was doing valuable work for the benefit of all, and where none of us were duplicating the work of the others. That is, instead of having all of us working along one particular line of research, we would have each man working along a different line and contributing his knowledge for the benefit of the fraternity. The scheme I proposed was virtually this: First, that an effort be made to induce everyone able to do valuable work for Associations to do certain work delegated to him and to do it for the benefit of all, and to locate the information required by means of a question box similar to the one in use by the Ohio Gas Light Association. The information gathered up from this question box would be passed on to a revision committee, and the revision committee would annotate these answers and see that the information furnished was correct and reliable. Where information had not been furnished either correctly or reliably, the revision committee would attempt to supply it. If it is not able to do this (and a great deal has been asked through the question box that I do not think our present gas literature will supply) the question will be placed in the hands of the research department, and, if necessary, experiments resorted to to secure the desired information. I made a particular plea for the annotation of our literature. Today the gas literature is distributed through an immense number of volumes, some of which are out of print, and it has never been properly indexed, nor has there been any attempt made to put it in concentrated form for the use of the gas engineer,—such as the information you will find in Kent's Handbook on the top of your library there. It is an extremely valuable book to mechanical engineers, and to gas engineers, too; but it does not contain the direct information to gas engineers which we all need. Scattered through that library will be found a great deal of the information which we do need, but it is so mixed up with other matter that it is hard to locate; and I doubt if any member of this Association has at his command such a library as we see there. Even though he might have that library, the lack of a proper index would prevent him from securing the educaton from it which he would obtain from that literature if it were re-written and properly indexed. Now there is one work that Associations can do. I believe they can greatly benefit and bring about progress among the best gas engineers in the world; but even assuming that they can not make the best better, they can bring the average and the new-comer into the gas business more on a par with the best gas men. And that has to be done largely by Association work,—by the standardization of methods, by special research work and a great deal of work that each gas man can not undertake for himself, but work that a gas Association can undertake for the benefit of its members and of the whole fraternity. We now have something like nine gas Associations in this country. They are all in a measure covering the same field of work. In no gas Association (and I do not wish to belittle the efforts of any) is any portion of the work followed up as aggressively as it might be if there were some way of consolidating all the talent in the country. Out of about 1,000 gas companies we only have 1,700 members, that is, there are only 1,700 men belonging to gas associations. Now it seems to me that we ought to have nearly 7,000 members, that is, every gas company, or the gas companies as a whole, ought to average seven members. That might not be so in this section of the country; but in the East we have a great many large companies, and some of them already have thirteen or fourteen men who are members of gas associations. I think there are something like thirty or forty gas companies that have no association membership as companies, nor do their officers or employees belong to any association. These companies will probably tell you that their position is peculiar and that they have nothing to gain by participation in an association. Now, I have not made a plea for consolidation. I have simply suggested it. But I believe that to do the best association work we must finally all affiliate or consolidate in some way. I think that the Pacific Coast Gas Association will be putting a brake on the wheels of progress if it refuses to appoint a committee to confer with the committees from the other Associations. You do not bind yourselves to enter into any sort of consolidation at all. It may be that all the associations will look with equal disfavor upon this proposal. But I believe the appointment of a committee of two representatives from this Association would result in an improvement to association work and benefit to the Pacific Coast Gas Association. And as the Pacific Coast Gas Association has been the first to meet since the Congress I am quite sure that their refusal would in a measure retard affiliation, or would retard the ease of affiliation, among the other associations of the country. You are in the position of setting an example (and after this I will say "we are" instead of "you are," for I have been a member for some time); and certainly the progressive reputation that is enjoyed by the Pacific Coast Gas Association would warrant us in doing what we can to at least consider the advisability of affiliation.

MR. LOWE—I am very glad now that a little over a year ago I sent an application for membership to Mr. Doherty and requested him to join the Association, which he did. I assure you, we made no mistake, and I am sure you will all agree with me. You know as well as I do that in having Mr. Doherty as a

member of our Association we have one of the leading gas engineers of the country and one of the greatest gas men in the world. I think that what Mr. Doherty has told us is worth considering. I feel at this moment in full accord with the committee who reported on the recommendations of our president. I am not sure, however, that we are correct. Time alone can tell, and it may be that nothing can be lost by the appointment of a committee to confer with the other associations. I know that we do not wish to do anything that will in any way retard the advancement or the welfare of the gas business at large.

MR. BRITTON—Mr. Doherty has put a new face on this matter to my mind. If this were a mere proposition of consolidation, I would be probably its most bitter opponent. I would not for an instant think of surrendering our charter, so to speak, to anyone else. But on the question of the formation of what you may call a "steering committee," as we call it in politics, or an advisory board that would serve to make all the associations work in synchronism and keep step, I would be in favor of it. And if the appointment of the committee, after the explanation of Mr. Doherty, is merely for the purpose of bringing out that point of his,—strengthening the plea for better association work, —then, with Mr. Lowe, I see no objection to it at all, and I should favor it. In the appointment of a committee they should be instructed positively that no action of theirs in joint committee should look to any consolidation of this Association with any other association formed, or to be formed. With that positive instruction coming from this body I can see no objection to the appointment of a committee to confer.

MR. DOHERTY—Mr. Chairman, as somebody suggests it, I will move that the resolution be amended to read: "That this Association instruct their president to appoint a committee of two to meet with the representatives of the other associations, but that the committee is not in any way authorized to bind the Pacific Coast Gas Association, and that such affirmative action can only be taken at the next annual convention."

MR. LOWE—I would suggest that you substitute "confer" for "meet." We might not be able to meet personally.

MR. MARTIN—I would suggest that you call it a "substitute" instead of an "amendment" as it does not amend the original resolution at all.

MR. LLOYD—Do I understand that this requires the committee to confer with the other associations or with like committees from the other associations?

THE PRESIDENT—There will be a committee named from each of the associations, and this committee will confer with the other committeemen.

MR. LOWE—When is this joint committee expected to report?

MR. DOHERTY—Mr. President, the joint committee can only report to the individual associations when they meet. But I take it that the representatives from our Association are expected to report at the next annual convention of the Association. It was the purpose to appoint two representatives from each association and three representatives from the gas men at large. This has been erroneously construed to mean that the three delegates at large should be appointed from those gas companies having no membership in any association. Now as they have no membership in any association, they can not act in unison; they have no organization through which they can act. The resolution adopted at the Gas Congress was that there should be three representatives of the gas fraternity, regardless of whether they did or did not belong to the present associations. It was also the purpose, I think, that the presidents at the time of the gas congress should appoint these representatives, and that they should confer as soon after as possible and be ready to report at the next meeting of the Associations. As far as I know there has been no action taken on the part of any of the associations as yet to appoint these committees; but it is the intention of three or four with whom I have talked to appoint these committees, and it is expected they will get into affiliation some time during the fall, I think. I was not instrumental in the passing of these resolutions. I simply suggested consolidation in my paper, and immediately after my paper was read the resolutions were offered. I did not even know they were to be offered.

The substitute motion was then carried, and, on motion of Mr. Lowe, the original report was laid temporarily on the table.

The report of the Nominating Committee was then presented by its chairman, Mr. Jones.

MR. JONES—As chairman it gives me a great deal of pleasure to have the honor of presenting in nomination the names of Mr. L. P. Lowe and Mr. John Martin and of these other gentlemen, because Mr. Lowe and Mr. Martin have done so much for the Gas Association. Mr. Lowe is my dearest friend, and Mr. Martin we all love and admire. I consider it a great privilege and an honor to be the chairman of your nominating committee.

On motion, duly seconded, the secretary was instructed to cast the ballot of the Association in accordance with the nominations of the committee; and the secretary thereupon announced that the ballot of the Association had been cast as follows: For president, Mr. L. P. Lowe; for vice-president, Mr. John Martin; for secretary and treasurer, Mr. John A. Britton; for board of directors, Mr. Frank J. Symmes, Mr. Christian Froelich, Mr. W. B. Cline and Mr. Frank A. Cressey.

MR. LOWE—Last year when I was elected vice-president I made a few remarks. I am not going to do any more now than to thank you for the honor, because it is a great honor for any man to preside over any of the gas associations of this country. and especially over the Pacific Coast Gas Association.

MR. MARTIN—Mr. President and members of the Pacific Coast Gas Association, I thank you very much for the honor you have conferred upon me, and I will try in every way to prevent the disbanding of the Pacific Coast Gas Association and at the same time co-operate with Brother Doherty in trying to build up better work in all the associations.

MR. LOWE—May I be permitted to make a few remarks on the change of date? Those of us who attended the last meeting of the Association are well aware of the fact that for the first time we missed the face of our brother, Mr. Jones. The reason was that he was taking a much needed rest and vacation. Had it not been for the death of a member of Mr. Martin's family we would have missed his face this year because of the fact that he also was about to take a vacation at the time when the session of the Gas Association is held. You are all undoubtedly aware of the fact that Mr. Martin's mother-in-law died while they were on their trip to Alaska. It seems to me that a vacation season is not the right time to hold a gas convention because a great many men must necessarily be away with their families, and if they attend the session of the Association they must to a certain extent sacrifice the pleasures and the vacations of their families. I think it would be better if we held our session later in the year. Mr. Jones told me that when July was originally chosen it was because the columns of the gas papers were open for our proceedings, those of the other associations not interfering. If we held our meetings in September, the same conditions would prevail. We would have passed the vacation season, and I am of the individual opinion that it would be more convenient for the members and that we would have a larger attendance. I do not know whether there is anything in our by-laws to interfere with a change of date, but, if not, I move that the proceedings of the Association hereafter be held at some time during the early part of September,—probably the second Tuesday, as we now have our meeting on the second Tuesday in July.

MR. JONES—I have heretofore opposed the changing of the date of meeting of the Association. In the early days of the Association July was selected because San Francisco was at that time of the year the best summer resort in California. In selecting the date Mr. Crockett and I considered the climatic conditions existing in other parts of California where the mercury gets out from the top of the thermometer. I found that a great many of our inland friends liked to come to San Francisco in the summer time to cool off. But since that time I have entirely changed my views, and before this discussion goes any further I want to withdraw the objections I previously had to changing the date of the meeting. I believe with Mr. Lowe, that if the

members feel they would like to have the date changed, September is a good month. The fixing of the date in July was simply a matter of sentiment. I feel that the members should consult their own interests now in selecting a proper time of year for the meeting. What Mr. Lowe says in regard to the columns of the gas journals is true, because the meeting of the Western Association in May keeps the gas papers busy through May and June, and the American meeting in October keeps the journals full for October and November, and sometimes December, so that if we had our meeting in the early autumn we would have the same advantage we now enjoy of having a proper reporting of our proceedings.

MR. MARTIN—I was very greatly surprised at the selfishness of our newly elected president. He wanted the honor of being president fourteen months instead of twelve. (Laughter). Now, as a matter of fact, I think the time of meeting as we now have it is the most convenient time of the year for the members from the interior gas companies. It is a time of the year when the majority of the people in their respective towns are away on their vacations, and when they have comparatively little to do. September is the beginning of their winter season and they have more to occupy them and less time for attending meetings. The trip to San Francisco in the month of July is more welcome because of the greater change, and while two or three of us may be absent from time to time, yet the interest is always maintained and I believe that you have a better attendance in July than you would in September. I hope that the members will think it judicious not to change the time of meeting,—or rather, the month of meeting.

MR. KEYES—I, for one, agree with our friend Mr. Lowe. So far as climatic conditions are concerned, I think we have in the interior, if anything, severer weather in September than in July; and so far as the ease of getting away on account of business conditions is concerned, it would not interfere more in September than in July. I am very much in favor of changing the date to September, and I would therefore second the motion of Mr. Lowe to have our meeting on the second Tuesday in September, if it does not conflict with our by-laws.

MR. LOWE—I want to say, gentlemen, that this is a matter which touches everyone of you, and it may be that you should not be called upon to decide hastily; and if some member will offer as a substitute the appointment of a committee to confer with the members, giving the committee power to change the date if they find it advisable, it would be quite as acceptable to me.

MR. HILL—It seems to me that this is not a very bad attendance for this time of the year, and I quite agree with Mr. Martin that this is the best season of the year for our meeting. The Association seems to prosper holding its meetings at this time of the year, and living in the country, I find it quite convenient to combine business and pleasure. I can run down here and have three or four days' of a good time and at the same time learn a great many things pertaining to business affairs; and I, for one, would be quite in favor of keeping the meeting where it is.

MR. JONES—Perhaps the fact that the schools are open in September may have something to do with it. Don't you go to school, any of you?

MR. GEO. P. LOW—I have an axe to grind. With all due respect for the opinion of Mr. Martin, I make this statement: As editor of THE JOURNAL OF ELECTRICITY, POWER AND GAS I can extend the assurance that if the meeting of the Association is held at some time other than July I can pledge you that the entire proceedings will appear in THE JOURNAL on the first of the coming month. It is impossible to bring this about in July on account of the meeting of the Pacific Coast Electric Transmission Association, which is held in June, but it would be easy to bring out the gas transactions if the meeting were held in September.

THE PRESIDENT—I may say, speaking personally, we will all have to make sacrifices, but I assure you I come here every July and the sacrifice I make personally in order to have the privilege of attending the meetings is very great. I ought not to come from Spokane in July. It is the warmest month of the year, and a great deal of work has to be done during my absence that I can keep in touch with only by the use of the telegraph. I am in accord with the sentiment expressed that we should change the date of the meeting, that is, if the by-laws will permit, which I am sure they will. But I am with the boys all the time, and if you do not think it wise to change the date from July, July is good enough for me.

MR. DOHERTY—I don't want to butt in on things here, but by request I offer as an amendment that a committee be appointed to canvass the sentiment of the members and be given power to change the date to the time suggested by Mr. Lowe.

MR. LLOYD—I offer as a substitute for the whole matter that the proposition to change the date of meeting be laid over to our next meeting. I do so for this purpose, that it will give the members of the Association a chance to see how they can shape their business for September if we desire to change the date to that time. We know now that we can attend the meeting in July, but whether our business will permit of our leaving it in September is another question.

THE PRESIDENT—I think you misapprehend the purport of the amendment. It is that you shall be conferred with during the ensuing year. We shall take no action until the committee has reported.

MR. LOWE—Let us assume that two-thirds of the members by a postal card vote, or something of the sort, desired to change the meeting. The committee, I am sure, if there were one single vote in favor of continuing the meeting in July, would continue it.

The amendment was carried viva voce, and the original motion, as amended, was then carried.

THE PRESIDENT—I think it proper, gentlemen, to make it known to you at this time on the introduction into office of Mr. Lowe, that these portraits of the past presidents of the Association, so elegantly framed, are the gift of our newly elected president. They will hang in the office of the Secretary of the Association until our next meeting.

The Secretary then read a letter from the Union Iron Works inviting the members of the Association to be present at the launching of the cruiser "South Dakota"; also a communication from THE JOURNAL OF ELECTRICITY, POWER AND GAS.

On motion of Mr. Martin the thanks of the Association were tendered to the Union Iron Works for their kind invitation.

THE PRESIDENT—Our next papers are on "American vs. English Gas Cooking Stoves," Short Topics by A. S. Main, Glasgow, Scotland, C. S. Barbour, London, England.

I regret to inform you that Mr. Trenkamp of Cleveland, has found it impossible to write the paper announced on the program; but, as usual we have found somebody to enter the breach, and our friend Mr. Henry Keyes has kindly consented to write a paper at short notice.

The papers of Mr. Main and of Mr. Barbour were then read by the secretary.*

In presenting his paper Mr. Keyes said: The only basis for the comparisons which I am about to make, as far as English stoves is concerned, is the range which you see in the rear of the hall. I was not requested to write this paper until the night before last, and as this range is the only one of foreign make I ever saw, of course I can only give you such impressions as I have formed from examining it; and I hope that any criticisms that I have written will be accepted by the writers of the other papers (should they happen to see them) in the same friendly spirit in which they are made.†

THE PRESIDENT—I feel sure that we need not apologize for the brevity of these papers as the mere announcement of such a topic has brought from the East our two friends Messrs. Roper and Kahn, who I am sure are able to take care of their side of the question. In order that the members might intelligently discuss this question I ordered an English gas range, which is in the Novelty Department, and which undoubtedly you have all inspected.

*THE JOURNAL, August, 1904, pages 320, 321.

†THE JOURNAL, August, 1904, page 322.

MR. LOWE—I should like to ask Mr. Keyes about the price of the stove. You stated that the English stove cost twice as much as the American. Do you mean the imported article?

MR. KEYES—I understood from our President that the cost of that stove was somewhere in the neighborhood of $25, and it is about the same size as the American stove alongside it which costs us about $13.

MR. LOWE—Do you mean in this country, duty paid?

THE PRESIDENT—The cost of the stove in England is about $25.

MR. MARTIN—I will not attempt to go into the details of stove manufacture other than as applied to our conditions. I have no doubt that our stove manufacturers will concede the fact that an insulated interior will give greater effectiveness than one that is not insulated, and that it is an advantage from the standpoint of a smaller gas bill. But, on the other hand, it is a disadvantage which we appreciate, especially in our smaller towns in the winter time. The greatest difficulty we have there is to get the people to use their stoves in the winter for the reason that there is not heat enough given off from the stove for the comfort and convenience of the person who does the cooking; and the consequence of that is that they use coal or wood stoves during the winter time to a greater or less extent. The inefficiency of an American stove from loss of heat by radiation is not as great from a practical standpoint in our towns as it would appear to be. I am inclined to think that the character of the baking that could be done in one of the English stoves would not be as good as that in the ovens designed for baking in the American stoves for the reason that you don't get the same application of heat and can not get the uniform baking quality. The durability of the English stove is quite evident; but, on the other hand, those of the managers who have watched the progress and development of the American made gas stoves, and particularly those managers who have pursued the policy of renting stoves at so much per month, will remember the fact that in one or two years, with improvements coming out, old stoves became practically junk because people wanted the latest improvements. There is such a thing as having a stove that will last too long. It is better to take the difference in cost and deposit it in the savings bank, and by the time you are ready for another and more modern stove, you will have money saved to buy it.

THE PRESIDENT—We should like very much to hear from Mr. Roper.

MR. ROPER—I did not come here prepared to discuss the question. I did not know what the gentlemen were going to say; but I think, as the gentleman here remarked, that our English friends wrote their papers after looking at a catalogue, and our friend here criticised the English made stove after seeing one,—about thirty minutes; so that I don't think either one of them is right. As to the English stove, there is no question but that it would be very fine in roasting—at 85 per cent more consumption of gas. You could do as good roasting in the ordinary type of American stove as in the English; but you don't. If you roast in the lower oven and baste meats frequently you will have exactly the same results as in the English stove. They have servants there, while in this country there is a kitchen girl running the house, who does the work as it is easiest. In one case you bake the meat, and in the other you broil it. So far as ventilation is concerned, they certainly have all the ventilation they want in the English stove; they get all kinds of ventilation; they carry a current of air through all the time, and the more air, the more gas they consume and waste. In regard to the English stoves being packed with asbestos and having great big heavy plates, the writer forgets that the air space in the American stove is worth more to us than mineral wool or asbestos. An American made stove today has an outside jacket, a sheet of asbestos, another jacket with an air space, and then an inside lining. I do not think there is a first-class American stove manufactured today but that the valve, instead of being a blunt end of pipe, is built more on the injector principle and then spread after the gas has passed so far. And we spend lots more money on valves and cocks than they do. I do not think I have had the pleasure of using an English stove. But I had the pleasure of meeting an English manufacturer once, and I had not been introduced to him more than two minutes when he told me that he had come over here to build gas stoves. Would I sell out? Unfortunately he was killed in an automobile accident; so we were saved that much competition.

MR. KAHN—The gentleman who has preceded me, Mr. Chairman, has so fully covered the ground that there is very little left to say about the lawsuit that is being defended (and which I am justified in describing as a lawsuit because of the form in which the question was printed). I do not think that the English critics have been as generous as they might have been if they really understood the facts that they should have known before they entered upon a discussion of the differences between the two forms of stoves. They manifestly discuss our gas ranges from the standpoint of an Englishman,—very much like the other Englishman who came over here, and after remaining for a week wrote a long history of American social conditions. The conditions in England I have no doubt are such, Mr. Chairman, that the gas range as it is built in England responds to the requirements of England and of Scotland and of Ireland very well indeed. There are a great many of the gas companies over there that are owned by the municipalities, to begin with, and then there are a great many other companies that find it necessary to rent out gas stoves before they can get the people to use them. And in that respect, Mr. Chairman, the English gas fraternity has undoubtedly furnished an example that the American gas fraternity might adopt with a great deal of benefit and profit. They require a first-class and durable stove. They desire to consider every stove that they put out under lease or rental to be a permanent asset of the company. The result is that the life of one of the English stoves is much greater than that of any American stove of which I have any personal knowledge. The conditions of climate in England, the damp, humid and saturated air of the British Islands, contributes very largely to the destruction of sheet steel. (This also occurs in this country.) And for those reasons they found it profitable and wise to adopt the form of range that they did. The necessity of cleaning up their ranges and scouring them after they came back from use, and the preparation of them to put them out into service again made very desirable the introduction of the interior porcelain plates. It is a good thing; and in that respect we in this country could profit, and ought to profit. But unfortunately the conditions in America are wholly unlike those in England. And I want to say, before I pass from the subject, that the English gas stove makers, so far as I know,—notwithstanding the splendid enterprise of the English manufacturers in general, occupying, as they do, almost every market of the world,—the English manufacturer of gas stoves has made no impression at all upon the gas appliance trade of the European continent. They do sell a good many things in Europe, but they have not succeeded, so far as I know, in selling any English gas stoves there. I speak somewhat knowingly on the subject because three years ago I made it my personal pleasure and business to investigate the gas appliance business in Europe, visiting a great many gas companies on the continent and nearly all those on the British Islands, and I found no gas stoves made in England anywhere on the continent. I did find a large number of American stoves on the continent, and there are a large number of American stoves going to the continent all the time; and I believe that as between the American stove and the English stove the continental gas engineer prefers the American, not only because it is cheaper, but because it is also more practicable. Yet the American gas stove does not possess the qualities for the European household that it does for the American household for the reason that the European household very rarely deals with the baking proposition. The European housewife goes to the baker. But while the baker thrives in this country, we still get away with an enormous quantity of home-made pies and an enormous number of good, old fashioned American biscuits, and I imagine that the majority of American families would consider it a great calamity if the art of making biscuits were totally lost. I am sure that the gas range as built in this country has

promoted the fancy, as well as the appetite, for biscuits; and I believe that it has robbed the biscuit of the serious objection that some wiseacres some time ago made against it, that it was detrimental to the maintenance of a good digestion. The American biscuit today is toothsome and a very useful adjunct to the American household, whether it be a rich one or a poor one. The English gas range is not capable of doing that class of work. The American gas range does it splendidly. I dare say there are very few gas ranges made in America of any standard quality that are not capable of producing as good a pan of biscuits as one could wish in from five to eight minutes, doing them to an absolutely perfect brown and making a splendid biscuit, and doing it upon considerably less than ten cubic feet of gas,—considerably less than five feet, if your oven is already heated to the desired temperature. We build in America a range that is nothing more or less than an evolution, a complete and thorough application to the wants of the American household. As a manufacturer I would say that the American gas company could very well, with much advantage to itself (I won't say, with any advantage to the manufacturer) sell a better grade of stove. It has been a very hard and a very thankless task for the manufacturer with any ambition to produce a first-class article to find no ready response from those whose business it is to buy the appliances that the American manufacturer could produce if he only could find a customer to buy. I am confident, gentlemen, knowing the stove business as I should (having been identified with it since my childhood) that the American consumer is ready to buy a better range than you have been offering him. He would be glad to pay for it. I believe the American gas company has grievously erred in assuming that a difference of $1 or $2, or even $5 in the price of a stove would militate against the adoption of fuel gas in the average American family. The American consumer is now buying a gas range at less than one-third of the price that he has been in the habit of paying all his life for a not extraordinarily good coal range. They pay from $35 to $40 or $50, and even as high as $75, if they want an apparatus of that kind; and the average gas range ought to outlast any coal or wood range or stove that he can buy anywhere, if he will but take ordinary care of it. And I wish to express my sincere hope, that the Pacific Coast Gas Association, which is so enterprising in other things, will furnish an example by the adoption of better ranges than they have been using heretofore, for the reason that it would inure wholly to their advantage. The gas appliance manufacturer is nothing but a very weak leaf which is blown through the air at the will and at the beck and at the call of those who buy his product. There are very few of us who are not able to produce a better stove, and who do not fully understand what ought to be produced, if we could only get people to buy and pay their cost, with a small amount of profit, which of course the manufacturer is bound to have. We can make whatever you require, and I imagine that if you insisted on our furnishing a stove that would cost less than those you are now buying, it would be produced. We are like the dressmaker who listens to her customer and puts on a green ribbon here and a red ribbon there and a little lace here, if the lady desires. That is substantially what we have to do. And if we have made any progress at all in the manufacture of gas stoves, it has been due solely,—as my friends here who are also in the manufacture of stoves will bear me out,—it has been due almost entirely to the exactions of some of the more enterprising gas engineers representing various companies. They have demanded this and that. I believe these gentlemen have demanded changes from time to time largely because of their own experience. I have in mind where in a certain city it was found that the cost of looking after the ranges that were in use amounted to an enormously large amount a year. I believe that it ran up as high as $2.25 a stove, they undertaking to look after all gas appliances. They found shortly after that one of the chief causes of this trouble was that the burners would rust and become filled up, or that the cocks would leak, or that the orifices of the valve would fill up, and that there was imperfect combustion; and in order to remedy that they had to take the whole thing apart. They then demanded adjusting valves and separable burners, and they submitted to us what seemed an impossible proposition, to make a separable burner that would furnish an absolutely efficient fire and that could be separated and cleaned out as readily as you could clean the dirt off your hand. The thing was done. In like manner we furnished a valve,—some of us did, some of us failed,—that would give them a thoroughly efficient fire, notwithstanding the presence of a needle valve in the center of the valve orifice. I have brought a sample of each of these things with me. I think I am safe in saying that, after the adoption of these little devices, according to the assertion of the engineer in charge of that department of the gas company, that whereas previously their men could take care of only two or three stoves a day, they are now amply able to take care of from fourteen to twenty. In other places they do not care anything at all for these devices. I don't want to take too much of your time. There is a great deal that might be said on the subject, but I would resume my seat by simply repeating again that we have nothing to learn; and I do not like to make that statement because we usually can learn even from those who know less than we do. There is a great deal they can't teach us simply because they do not know the domestic family conditions of the United States. There is a great deal on the other hand that they can learn from us; and I would say to our English cousins that unless they are exceedingly careful they will find that it will not be very long before they will be glad to take up the manufacture of American types, if they care to preserve their trade.

MR. DOHERTY—Many of the problems connected with the relative values of these stoves seem to be treated as matters of opinion instead of matters of demonstration. What we want in oven is uniformity of temperature and economy of heat; and such questions as these do not lie within the opinion of any man; they are simply matters of demonstration. Many of the statements made in the English papers I do not think are in accord with good engineering practice. They speak of "moist heat," and one of them speaks of moist heat in an oven. Now, as far as I know, heat is not subject to carrying moisture itself, and the writer probably meant that he was producing more or less water vapor and carrying it through the oven chambers. Now as that vapor is superheated, it would behave as a permanent gas, and the drying effect would be the same as if he had a permanent gas instead of a superheated vapor. He makes another point about not drying up the meat, and then he tells you about the immense currents of air. This, it seems to me, is inconsistent, because if he were loading that air with moisture, the more air he put through, the more he would dry up his meats. I am rather out of sympathy with any sort of combination appliance, broiler, baker and toaster, or what not, because, as a rule, you want individual control. You don't want the same amount of gas consumption for your baking and your broiling. The criticisms the English engineers offer on the arrangement of the broiler at the bottom I am in sympathy with, and I do not think that anything less than the continuous pushing of the kind of stove we now sell would have made it possible to find a market for it. I think that eventually we will have to come to a high broiler. I do not believe the broiler is used as much as it should be, simply because it is in an inconvenient location. Mr. Martin advocates radiation from the stove. I do not advocate radiation, even for the conditions prevailing here, and I would not advocate it in the East. One of the greatest advantages of the gas stove is that it keeps the kitchen cooler. If it is desirable to get heat, it is a simple matter to open the broiler door; and it is always possible, if you have your stove well insulated, to let some heat out into the room, while if it is not insulated, you can not keep the heat within the stove. The English writers speak about radiation as though that were the only heat loss. The big heat loss is not in radiation but in the heat carried off in the products of combustion. I think that 75 per cent of the heat value of your gas goes through the flue even in your American stove. It is over-ventilated now.

Mr. Kahn rather advocated the renting of stoves in America. I do not believe the plan is very successful, and I do know that

stoves can be sold if they are pushed aggressively, and that the present price of stoves puts them within reach of practically everybody. When you sell a stove you have a permanent consumer, and the cost of the time of your salesman and your stove man is about as great for renting a stove as for selling it.

A great point has been made for English stoves on the score of durability. We constantly have stoves brought in for repairs that have been out twenty years; besides this, the point Mr. Martin makes about paying less for the stove and putting the money thus saved out at interest is an excellent one. Durability beyond a certain point is rank extravagance; and I think this is so of the English gas stove, if applied to American conditions. We could better afford to buy more stoves; and the total charge per year against the American gas stove would be less in spite of the durability of the English stove,—the asserted durability, which I know nothing about. It also might be of interest to call your attention to the fact that one American manufacturer did manufacture the English type of stove and abandoned it because it was not suitable to our needs. One of the objections to the English stove is the lack of uniformity of temperature in the oven. Now what I said before was intended simply to put in a plea for better Association work. As an example: The Ohio Gas Light Association has tried to outline standard methods of testing fuel gas appliances. They have changed them from time to time with the hope of eventually getting a perfect method; but, as far as I know, no attention has been paid to the work of the Ohio Gas Light Association by any other association, as an association. Some work has been done by individuals. But co-operation in work of this kind ought to exist between gas associations. Perhaps the methods outlined by the Ohio Gas Light Association are very poor. If so, it is up to the other associations to find some better methods; and instead of taking a great deal of time to discuss the relative value of these stoves, as though it were a matter of opinion, we ought to adopt standard methods of measurement. Anyone can now use any method he likes and get any result he likes.

MR. KAHN—I merely want to correct Mr. Doherty's reference to a statement I made. I did not advocate the renting of ranges nor did I oppose it; I merely referred to a case where they found it desirable to rent stoves and where these rented stoves, because of the fact that they were rented, received very poor attention and were necessarily brought to ruin in much less time than would be the case where the parties owned the stoves.

MR. LOWE—I would like to ask Mr. Kahn how he would improve the American stove. You say that we should buy a better stove and that the manufacturers are ready to sell us a better stove. To what extent could you improve a stove at an additional cost of $2 or $3?

MR. KAHN—I should personally prefer (though I know that I may have a lot of bricks thrown at my head for saying it)—I should personally prefer an all-cast stove to a sheet steel stove.

MR. LOWE—Because it would be more economical?

MR. KAHN—I believe it is better in all respects, especially as compared with such a sheet steel construction as is generally called for now. I would have heavier gas supply parts; I would have more threads on the valves to make them stiffer; and I would do some other things that I consider somewhat better, but they are trifling, and not necessarily important in determining the quality of the range. But that is the principal idea in my mind, to make an all cast range in preference to a sheet steel range.

MR. LOWE—It ought to make a more substantial stove. Do you consider the enameled ovens an advantage over the black ovens?

MR. KAHN—I think they are so decidedly, although it would be done at the expense of economy of fuel consumption. You can not take a light sheet steel plate and get along at all in enameling it. You would necessarily have to use a heavier plate than is now used and it would take more gas to heat it.

MR. LOWE—Would the consumption of gas be increased for any other reason, for instance, in the way of radiation of heat?

MR. KAHN—I think not. I do not think you would lose anything on that account.

MR. LOWE—We are all familiar with the appearance of the English stoves, because many of us subscribe to the English journals, but, generally, we know nothing of the German and the French stoves. How do they compare with the American stoves?

MR. KAHN—The French stove, Mr. Lowe, is built very much on the order of the original American stove. Possibly it would be better to say that the original American stove was a copy of the original French stove. The French stove was brought over here first by Mr. Goodwin, and possibly some other gentlemen in Philadelphia, and it was, as you remember, a stove with a baking oven on top and a grill underneath. The grill was open. That was really the beginning of the evolution which has produced the American stove. They still continue in France to make a stove of that type. In Germany they are copying our American stove, to a great extent, if not absolutely. They have a very high opinion of American productions. They do not hesitate to buy our castings and file them up. Our English friends have done that, but not so much as the Germans. At the last Paris Exposition there was at least one Danish exhibitor, a Dutch exhibitor and quite a number of English exhibitors who had the assurance to bring to that exposition stoves that were pirated from American production. In general, I may say that the German stove is not better described than by the statement that it is similar to the American type. In Switzerland they produce no gas stoves; they import them all. The same may be said of Holland, which is perhaps the best customer we now have in Europe for American gas ranges and other heating and cooking appliances. The same might be said, possibly, of Belgium. They are not only copying our gas ranges, but they are purchasing our so-called gas radiators for heating purposes. There are thousands exported every year.

MR. LOWE—Do they use the American or the English type of stove in Canada?

MR. KAHN—Altogether the American stove.

MR. JONES—It seems to me that one point of utility in the English stove has been overlooked; I should like to ask if it is not possible to use the English stove for cooking during the day and also as a fire-proof safe in which to keep valuables during the night? (Laughter.)

MR. HOLLIDGE—I believe in discussing the question of these stoves in a spirit of fairness, and it seems to me the gentlemen have not struck the point which I think they ought to have got under consideration. First, if I understand the methods of cooking in our country and in England, they are two very different systems. The system of cooking in the United States is a great deal on the baking plan, as suggested by Mr. Kahn, while in Great Britain a great deal of the cooking is done by boiling and steaming and what they term "roasting," and what we term "roasting" is what they term "baking." They monopolize the whole oven with a small joint. It is so different from our cooking. In the center of the English oven there is a ring bolt and a hook; attached to that there is a little spring that is purchased for a mere song, and the meat is hooked to this spring and continually revolves in the oven until the spring runs entirely down. These springs run for about two hours, and by that time they generally figure that the joint is cooked through. There is a good deal of basting, with a dish underneath, which occupies a good deal of time and as a natural consequence takes more gas. Bear in mind, too, that if you take a gas cooking stove with regulated shutters for the Bunsen burners and a gas stove that has no regulation at all, and light the two, the one that is properly adjusted will give off the most heat and burn the least gas, and the one that is not adjusted and has no shutter will burn more gas and give less heat from the fact of drawing in more cold air and thereby depreciating the flame; and it will not give a satisfactory flame to do cooking with, either on top or in the ovens. Another thing to be considered is the weight of the stoves. The English stove which Mr. Aldrich has so kindly brought here weighs, I believe, 800

pounds, whereas an American stove can be placed by one man. Of course the difference in the cost of the stoves is also very great; one is $25 and the other about half that. And if a man can get a good stove delivered for $12, he is certainly not going to pay $24. I could go on and enumerate several other points in which I think, in a spirit of fairness and justice, the English stove does not come up to the American in any way, shape or form. I must say that the white enamel is a good departure and that the English stove seems to me neat and attractive. On the other hand, as Mr. Kahn has said, the white enamel decreases the heat inside the oven and will not give you as satisfactory a cooking heat. It will reduce the heat, thereby using more gas. I think that if you will look at the stoves and take them both into consideration, the question will be settled without either judge or jury, in the spirit of what I term honest fairness.

MR. ROPER—I think that Mr. Kahn and the gentleman who spoke last are a little off. I have been making tests with enamel. It reflects the heat and will not absorb it as much as the ordinary steel range we now have. The consequence is that the enameled oven does not take up and waste the heat. It really saves it. You would be working with reflectors, to a large extent, that you don't get in the ordinary make of stove. While I am not positive, and would not make the statement emphatically, I am of the opinion that it really would be the most economical thing we could do in the American stove to enamel it, provided the enamel will stand on the sheet steel. I would like to say another thing. I was led by one of our first-class engineers into making a lot of tests, and this so-called true combustion and getting so many heat units and so on by the adjustment of a valve is very largely theory. If you adjust those stoves or burners so that there is not perfect combustion, and will produce a little marsh gas and burn it up, you can get better results than by adjusting the same burner so that there is so-called perfect combustion.

MR. KAHN—I would like one word. I think the last speaker and possibly some other gentlemen misunderstood what I said. I did not say that the enamel itself would make slower baking. I did say that it would require much heavier plates to put the enamel on and that, therefore, it would require longer to do the work than would be the case if the plates were lighter, the slow baking being due not so much to the enamel as to the heavier plate.

MR. LOWE—I raised the question of the enameling of the ovens not because I was seeking information on it, but to get the opinions of the stove manufacturers. I am of the opinion that the enamel is a poor thing from the point of view of economy. If you were firing a steam boiler and had enameled sheets you would not get much heat into the water, and if you are depending upon the heat that comes from the sheets into the oven, and enamel the oven, it is exactly like insulating. I think it is a very poor thing, though it certainly is nice from the point of view of cleanliness. I am satisfied that a thin sheet of enamel will use a great deal more gas to do the same work.

MR. JONES—But, Mr. Lowe, you must stop to think that in the case of the steam boiler your heat would have to penetrate from the outside through the enamel, while in the case of the stove lining the white enamel merely reflects the heat inside.

MR. LOWE—That is, if you are passing the products of combustion through the oven.

MR. KAHN—Which is the case in the gas range.

MR. LOWE—And erroneously so. I am speaking of cases where the heat surrounds the oven, and I am satisfied that is the only proper way.

MR. ROPER—The so-called gas range that we are now making has seen its last days. The coming stove will have a single oven and a broiler and will be more substantial.

MR. LOWE—Do you not think that it will be built somewhat on the line of the successful coal stove?

MR. ROPER—I did not know that there was a successful coal stove. (Great laughter and prolonged applause).

On motion a hearty vote of thanks was extended to Mr. Main, Mr. Barbour and Mr. Keyes for their interesting and instructive papers.

Mr. Lowe then presented his paper on: "Some Practical Observations on the Flow of Gases in Pipes."*

MR. DOHERTY—One thing that interested me very much was that Mr. Lowe had a "variable constant," a constant that was not a constant. I would suggest that he get another name for it. (Laughter.)

MR. LOWE—I will accept your suggestion if you give one.

MR. JONES—Why not call it a variable, leaving out the word "constant?"

MR. LOWE—It is a constant for a given size of pipe; but this formula contemplates the flow of gas through pipes from one-half inch to twenty-four inches. I did not see any way of expressing it better. It is a constant so far as one size of pipe is concerned. For every size of pipe until you get into the relatively large sizes you must vary your constant,—use a separate constant for each size.

In connection with digging up this information I must say that it is not very much to the credit of the engineers in the East that they can give us so little information. Mr. Martin and I were very much interested in the study of the transmission of gas through long lines under high pressure, and traveled together in the East seeking information. Finally we arrived at a town in Connecticut where we met a gentleman who had had a great deal of experience in the transmission of natural gas; but while he would answer our questions off-hand by a little sliding rule, he would not let us see it. However, since then I have built one of my own (showing it), and we now have a slide rule that works this formula immediately. It has been my intention to publish it, but I can not devote much time to these matters, and do very little more than go into the general subject and then pass it on to one of my engineers. The development of the slide-rule has been due to my engineer, Mr. Horne, rather than to me.

MR. DOHERTY—I am not able to state, Mr. Chairman, whether that formula would work or not. What I have been anxious to do is to develop a rational formula for computing flow for any pressure. I have also felt that any liquid ought to follow the same general law and that the one or two constants we should add would be density and friction, and then that would bring your gas formula and your liquid formula together and get rid of this variable constant of Mr. Lowe's. I have been trying to find out and to put the value of the wetted sides of my barometer (which would correspond in a gas pipe to the walls of the pipe) below as a detracting factor. Now I would like to ask what the figures .0761 are?

MR. LOWE—That is the weight of one cubic foot of air. The pole formula does not take into consideration the difference of pressure. It takes into consideration initial pressure only. It would be better if you consider "P" as difference of pressure rather than initial pressure.

MR. DOHERTY—I have seen it in some old book that "P" is to be taken as difference of pressure.

MR. LOWE—Even then it does not take into consideration the question of increased volume of free gases due to compression. As a matter of fact this lower formula is a modification and development of the D'Arcy formula. If you will seek in other fields, as I was compelled to, for information on the flow of gas, you will find that the most reliable information is that concerning the flow of steam The same laws that govern the flow of steam (with allowance for difference of specific gravity of gas and steam, as over the ordinary gas), you will find very useful in investigating flow of other gases.

MR. DOHERTY—While not called upon to do so, I would like to apologize for those engineers that Mr. Lowe found so reticent. I think I can explain the reason. They did not have the formulas and they did not know. When they have something up their sleeve it is generally a little table that is published by the compressor people. It is to cover their own ignorance.

MR. LOWE—I do not think you are quite right. I did seek information from the compressor builders, thinking they would

*THE JOURNAL, August, 1904, page 320.

know about it; and to specific problems they would give replies, and they went to some trouble to work out problems for us. I am satisfied Mr. Oliphant has a great deal of information on the subject. Now that he has published a formula, and one that is intended to be as simple as possible, it shows his good intentions. From other sources I was unable to obtain anything more than a solution of problems, largely from machine builders who hoped to sell us their product. We consulted all sources of information we could find, including experiments with compressed air over five or six miles of pipe, and even then it was a matter of two or three years' work.

MR. MARTIN—There is one thing rather peculiar in regard to our investigations of high pressure. The results we obtained from this gentleman in Connecticut were within a fraction, say one and one-half per cent of being the same results obtained by the formula Mr. Lowe presents. His results were obtained by over 20,000 observations taken on pipe.

MR. DOHERTY—The point I wanted to make is this: High pressures (and that is a comparative term) are now new in the gas business. They have been used for some time. The great advantages of high pressures, as they have been advocated by engineers during the last five or ten years, were not apparent by any formula, and they did not give us anything as a substitute for Pole's formula; and I hold that a knowledge of the flow of gas in pipes was either not possessed by any of the engineers in the gas business, or else that they were very selfish in the use of that formula. Now your flow only goes up as the square root of your pressure, and before you get much increased conductivity by the use of high pressures your pressure has gone beyond all bounds. And while I am aware of the fact that high pressure gas distribution is with us, and is here to stay, it has been an evolution in which the cart has gone before the horse,

MR. LOWE—I do not believe that any of the gas men, as we know them, had much knowledge of this subject and surely I could not find any. I want to say that in writing this paper my principal object was to call attention to two things: One is that you need have no fear as to very great injury to your gas because of compression—no matter what practical pressure; and the other is that it is absolutely necessary to use long sweep fittings and good long ones at that if you are going to get all the benefits of high pressure.

On motion of Mr. Martin a vote of thanks was tendered Mr. Lowe for his able paper.

Mr. Britton then presented his paper "From a Consumer's Standpoint."*

MR. BRITTON—I think it proper that instead of the ordinary formal vote of thanks to our host today, that we should adopt proper resolutions showing our appreciation of the very great help that the Mechanics' Institute has been to us at this meeting. I have not had the time to prepare the resolutions, but if you will confide it to my care, I will see that the proper resolutions are prepared for presentation to the Mechanics' Institute. The motion was unanimously adopted.

THE PRESIDENT—The Experience Department will have a hearing at the outing at Alum Rock tomorrow.

Now, gentlemen, my task is done. It is with a very great amount of pleasure that I hand over this gavel to my respected successor. With the knowledge that my position has been a responsible one, as it is no less an honorable one, I will simply say that I have endeavored to do my duty in my humble way, and if I have in some measure succeeded in making this a successful convention, I am more than repaid for the many sleepless nights I have had. Gentlemen, I thank you for your attention.

THE PRESIDENT—The Association will now stand adjourned, to meet at the banquet this evening.

NAPHTHALENE.

BY PAUL W. PRUTZMAN.

AN inquiry in the Question Box at the last session of the Pacific Coast Gas Association† elicited a very complete answer as to the chemical constitution of this substance, and suggested that a few notes as to the commoner physical properties might be of interest.

Naphthalene is produced in distilling bituminous coal, petroleum and other substances at high temperatures. It is not contained in the original substance, but is formed by the heat, the proportion of naphthalene in the tar depending principally on the temperature at which distillation is conducted. Thus tars formed at low red heats, such as those from the old iron coal retorts, or from the distillation of oil in retorts (Pintsch process), contain little or none; tars made at higher heats yield more and more, as the temperature rises, up to the highest heat possible in a clay retort. Tars from carburetting water gas follow the same rule of increasing naphthalene percentage with increasing temperature, but where the heats are so high that the tars are decomposed and lampblack formed, the naphthalene yield sharply decreases, indicating that the temperature at which naphthalene is decomposed into carbon and other products lies somewhere about a white heat.

More or less naphthalene is formed in all modern gas making processes, and as is well known, is often a serious nuisance. This nuisance is due to the fact that naphthalene, while a hard solid, is very volatile, lumps placed in the open air rapidly disappearing. The vapor of naphthalene mixes readily with all gases, the proportion taken up depending on the temperature of the gas, warm gases absorbing much more than cold. It follows that if a gas is saturated with naphthalene while warm, part of the solid substance will be deposited if the temperature of the gas is lowered. Naphthalene thus separated will form crystals on any solid with which the gas is in contact: these crystals will sometimes be shining loose flakes, resembling enormous snow flakes, but more often will form hard crusts consisting of granular crystals, usually of the size of sand grains, though sometimes much larger.

Naphthalene is very soluble in tar oils at ordinary temperatures, but is almost entirely crystallized out at the freezing point of water. Where solutions of naphthalene in tar oil are allowed to cool slowly the crystals will be large, if the solutions cool rapidly the crystals will be small: in either case the crystals will set the oil to a solid mass which will stand some little pressure without breaking, but which can be stirred up to a thin paste that flows readily. Where crystals and oils are allowed to stand in contact for any length of time the individual crystals disappear, the naphthalene drawing up into hard curdy masses that are very difficult to break. When in this condition naphthalene is very slowly soluble, but can be readily removed by heating to its melting point, 175° F.

Naphthalene is soluble in alcohol, ether, chloroform and most of the other organic solvents, and particularly soluble in gasoline, less so in kerosene and the heavier petroleum products. When a gasoline solution is allowed to evaporate slowly, naphthalene and gasoline will evaporate together, but where the evaporation of the gasoline is rapid, naphthalene crystals will be left behind.

Naphthalene burns very readily, with a very luminous flame, giving off dense smoke when burned alone. Were it possible to keep it in the gas it would be an ideal enriching agent, as weight for weight its light-giving powers are probably equal to those of any known substance. Many devices intended to burn its vapor have been produced, but as these arrangements all include an arrangement for keeping the naphthalene melted under pressure, they have proven too complicated to be of practical service.

When purified by pressing, treatment with acid, and sublimation, naphthalene is used as "tar camphor" and in the form of "moth balls" as a disinfectant and insecticide, and a small amount is consumed in the manufacture of red and yellow dyes.

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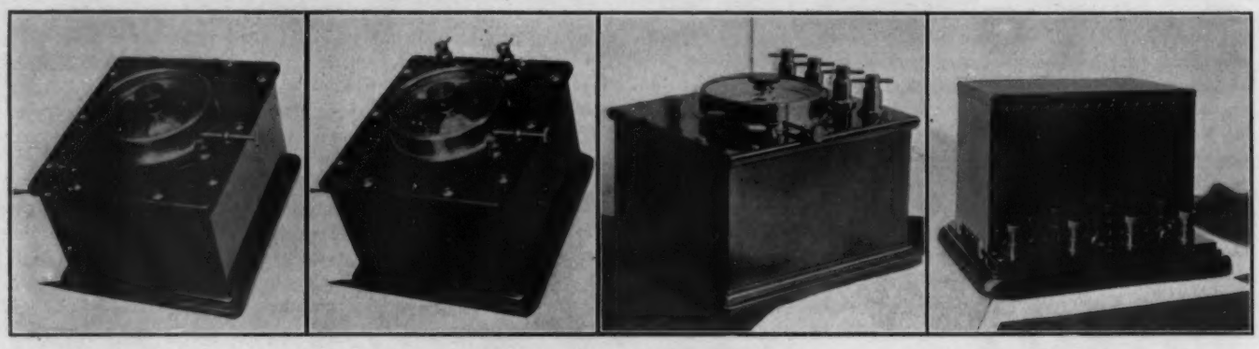
* THE JOURNAL, August, 1904, page 326.

† The JOURNAL, Volume XIV, p. 328, August, 1904.

INDUSTRIAL

NEW INSTRUMENTS OF PRECISION.

Accurate measurements are an absolute necessity in electrical practice. This is particularly true in the commercial branches, where the receipts are determined by the records of service meters upon the consumption circuits. Because of this urgent need for accuracy, switchboard and service meters of a high order have been developed and have come into general use, and their adoption has made necessary the use of instruments of a still higher order by which their accuracy and permanency may be checked. In view of the comparatively small number of standard instruments used as compared with switchboard and service meters, it is perhaps not surprising that the development of the latter has outstripped that of the former, and that a point has been reached where the instruments to be checked have a greater range and a higher accuracy than those by which their performance is measured. That such a condition does exist is well known by those who have to do with the testing and calibration of electrical meters.



VOLTMETER AMMETER WATTMETER RESISTANCE FOR POTENTIAL CIRCUITS

NEW INSTRUMENTS OF PRECISION OF THE WESTINGHOUSE COMPANY

In order to bring the standardization of electrical instruments to a place in keeping with its importance, the Westinghouse Electric & Manufacturing Company has developed a line of instruments of precision which combine the accuracy of the best known standards with the portability and rapid and easy manipulation of the testing instruments now in vogue. The advantages of both types have been retained, with the elimination of those features which detract from their value in general use.

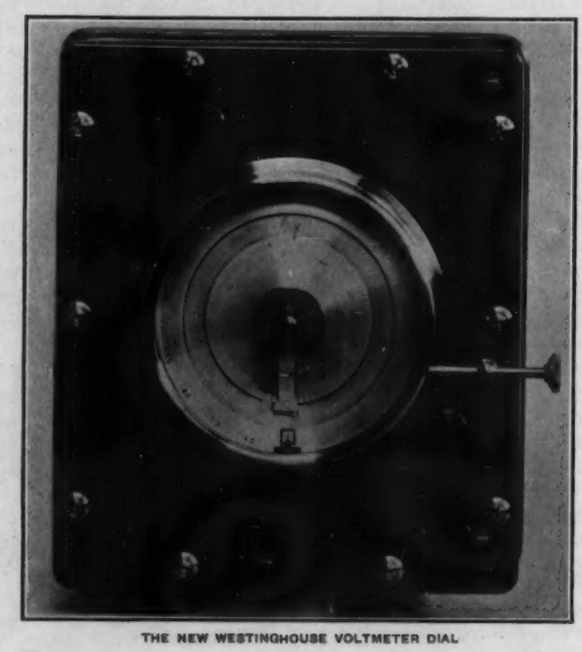
Having provided instruments of superior quality, the company named proposes to secure to purchasers a continuation of their initial accuracy by keeping them in calibration for five years without charge. All the facilities of the Westinghouse Departments of Standards are placed at the service of possessors of these instruments of precision so far as may be necessary to keep them accurate. Special shipping cases are provided to minimize the labor of packing and shipping. At any time within the period named customers may ship these instruments to the Westinghouse Department of Standards to be checked, and the work will be done promptly with no cost to the owners except that of carriage.

By first providing instruments which fulfill perfectly the needs of the laboratory and testing room, and by then insuring their continued accuracy, all the present trouble with checking standards is eliminated, and a new system for their care is inaugurated.

The illustrations show the voltmeter, ammeter, wattmeter and the resistance or multiplier used with voltmeter and wattmeter. The cases of the instruments are of polished mahogany, with all exposed parts finely finished. The mechanism is mounted in a cast frame made of a high resistance alloy, and suspended from the top plate. This is made of black enameled slate, giving a rigid construction and not affected by warping or changes in temperature. In principle, these instruments operate on the mutual attraction between two systems of movable and stationary coils arranged in inductive relation to each other, the two systems of coils being so arranged as to neutralize the mutual induction and the effect produced by any external field. The readings are thus equally accurate with direct and alternating currents and there is no necessity for reversing the readings on direct currents as with ordinary standards. The controlling force is very large, rendering negligible any friction effects, and presenting in this respect a strong contrast to the ordinary standards, in some of which the controlling force is so slight that the static attraction produced by rubbing the glass over the dial will introduce an error.

The voltmeter dial, also illustrated, shows the general form used in the different instruments. The scale is accurately graduated upon a five-inch circle, all the divisions being uniform and thus equally legible over the entire range. By means of the vernier, tenths of a division may be read, giving a range of 2,000 readable divisions, greatly exceeding the readable range of any other standard instrument in general use.

The sight wire is shown in a square frame which is attached to the movable system. When current passes through the instrument, the sight wire is carried to the right of zero. By means of the large knob the vernier is turned to the left until the sight wire is approximately upon zero, a fine adjustment being ob-



THE NEW WESTINGHOUSE VOLTMETER DIAL

tained by the knob upon the right. The two rubber covered voltage terminals are also seen, with the stop for holding the movable element in a fixed position when the instrument is not in use.

The voltmeter and ammeter dials are similar. The inner graduations are so spaced that their value is proportional to the square root of the deflection, allowing readings to be taken direct, without calculation. When readings of fractional parts of divisions are required, the outside scale with the vernier may be used and the corresponding value of the reading on the inner scale determined from the table of square roots furnished with each instrument. In the wattmeter there is but one set of graduations, similar to those shown on the outer circle of the voltmeter scale. The resistances are accurately checked, and thus form standards the voltmeter and wattmeter. The potential coils of the instruments are adjusted to a uniform resistance of 100 ohms, and the external resistance is subdivided so as to give total values of 1,000 ohms, or multiples thereof. When in use a resistance of 1,000 ohms is employed for each 100 volts nominal potential.

The resistance or multiplier is used in the potential circuit of of resistance, as well as measuring instruments. As the same values are used for both voltmeter and wattmeter, one resistance will answer for both instruments.

The facilities afforded for accurate observation are worthy of special mention, and perhaps can be best appreciated by comparison with the instruments now in general use by comparing the fineness of the sight wire with the width of the pointer in the ordinary standard instruments; the narrow, even, machine-cut division lines of the scale with the hand-drawn irregular lines of other instruments; and the open divisions of uniform length, giving equal legibility at all points, with other scales, the end divisions of which are little if any wider than the lines which divide them or the pointer that indicates the reading. This superiority, which is readily apparent, extends as well to other parts of the instruments, and to the design upon which they are constructed. They are in every way fitted for the checking of electrical metering devices and the accurate measurement of electrical quantities, while the free calibration insures the perpetuation of their accuracy.

CALIFORNIA WATER POWERS.

Of the many natural advantages furnished by California, not the least are its numerous waterfalls. They are not generally of the spectacular order, as Niagara, although, in the Yosemite Valley and other parts of the State, one may find waterfalls which rival that famous sight in grandeur. Particular reference is made to the waterfalls which, hidden away in the mountains, are caught in pipes and harnessed to water wheels and whose energy is transmitted electrically to large Coast cities. Thousands of miles of pole lines traverse the State and make possible the utilization of water under pressures heretofore unheard of in actual practice. As an instance may be cited the plant of the Edison Electric Company, near Redlands, where a Pelton water wheel is operating under a head of 1,950 feet—equivalent to 850 pounds pressure per square inch. This wheel is direct coupled to an electric generator of 1,000 horse power capacity, and the current is transmitted to Los Angeles—the station being one of several that are controlled by the same electric system, which has a large number of Pelton wheels in use operating under heads ranging from 100 feet up to the above-named, 1,950 feet.

It is interesting to note that, under such an extreme pressure as this, the water issuing from the nozzle may be likened to a bar of steel, and by actual experiments it has been found that a sledge hammer will have no effect upon it, owing to its density. It naturally requires the nicest mechanical workmanship and design to construct a wheel to withstand such severe conditions.

The demands for cheap power, together with the advantages of water at hand, naturally enough led to the development of a water wheel to supply the connecting link; and it was a pioneer Californian, L. A. Pelton, who first conceived the idea of a water wheel to operate under high heads.

"In the days of '49," this wheel was called the "Hurdy Gurdy" wheel, and consisted of a wooden rim to which was bolted cast iron cups, or "buckets" as they are technically called. The water impinging on the buckets through a round nozzle, caused the wheel to revolve and the peculiar shape of the buckets enabled a high useful effect to be obtained from the water. Later on the fundamental patents were acquired by The Pelton Water Wheel Company, which, by experiment, further developed the original idea—of course making radical changes in design and construction—and succeeded in producing a wheel from which extraordinary results are obtained. An efficiency of 90 per cent has been reached by the use of this wheel, which, however, was under most favorable conditions; but efficiencies of 80 and 85 per cent are easily realized in actual practice.

The Pelton Water Wheel Company, with headquarters in San Francisco, has built up a large industry in the manufacture of water wheels alone, having given exclusive attention to this specialty. In the last sixteen years it has installed over 11,000 wheels, aggregating in excess of one million horse power—the power ranging from a fraction of one horse power up to 10,000 horse power in a single wheel unit.

It is indicative of enterprise that one may find this California machinery product in use for driving fans in a bungalow in India, and, again, for operating a 30,000 horse power electric plant in Washington.

STEAM TURBINE CONDENSING OUTFITS.

At the present time much interest centers in the steam turbine, which promises to reduce the weight and cost of prime movers. Two large machines of this type are on exhibition in block 51, aisle 1, and block 44, aisle 10, Machinery Building, at the St. Louis Fair, one being shown by the Westinghouse Machine Company and the other by the General Electric Company. Economic utilization of the energy of steam requires its expansion to the lowest possible pressure, which in the turbine is accomplished without the usual losses due to the corresponding extremely low temperatures. In actual service the economy of the turbine is increased by approximately 3 to 5 per cent for each inch of vacuum higher than 26 inches. It is therefore of vital importance that all losses should be reduced to a minimum. The absence of oil from the steam renders the use of a surface condenser desirable in places where the saving of condensed steam is important. The fact that the final temperature of the condensing water must be comparatively low necessitates the highest degree of efficiency in its use and the immediate and complete removal of all noncondensible vapors, whose presence would increase the absolute pressure and consequently reduce the efficiency of the turbine.

The steam from the Westinghouse-Parsons turbines at block 51 is condensed in a 1,500-square-foot surface condenser, supplied by Henry R. Worthington. The air is removed by a Worthington rotative dry vacuum pump of the center crank type, but similar in other respects to the horizontal pumps already described. An air cooler is interposed between the condenser and the vacuum pump, considerably increasing the capacity and efficiency of the latter. The condensed steam is removed from the condenser by a Worthington volute pump directly connected to an induction motor. The operation of this pump is very interesting, since it requires neither valves nor floats and is not subject to vapor binding, as are reciprocating pumps. The pump is placed below the level of the condenser, receiving the water by gravity, and its capacity is such that it runs ahead of the supply, so that the suction pipe is never full. The discharge pipe is, however, always full and pressing back against the pump, but so long as the latter is in motion there is no possibility of the water passing back to the condenser, so no automatic devices are needed. In another turbine plant a pump of this character returns the hot water directly from the surface condenser to the boiler against a pressure of 250 pounds.

The Curtis steam turbine, exhibited by the General Electric Company in block 44, is of the vertical type, and the condenser is placed in the base of the steam turbine. It contains 8,000 square

feet of tube surface, and was built by Henry R. Worthington. The air is removed by a rotative dry vacuum pump, similar as regards the air end, to those heretofore described, but driven through the medium of a silent chain by an electric motor.

THE BIG ENGINE AT THE ST. LOUIS EXPOSITION.

The central feature of the machinery exhibits at the World's Fair in St. Louis is the huge Allis-Chalmers engine coupled to a Bullock Electric Generator. This colossal unit is the most powerful ever placed on exhibition. The engine is capable of developing 3,000 horse power when operating condensing, at 150 pounds pressure of steam, and running at seventy-five revolutions per minute. But it is not merely a display feature; it furnishes the electric current for the now world-famous decorative lighting of the buildings and grounds, for which about 200,000 incandescent lamps are required. The exhibition authorities frequently employ it for other purposes as well, sometimes for operating the cascades and sometimes for general power purposes. Recently it was suddenly called upon to take the entire load ordinarily carried during the day by a large plant in the same building, and aggregating about 5,400 horse power. Having carried this load as long as it was needed, the Allis-Chalmers giant then took up the regular lighting work for the evening. This engine and generator have been constantly ready for any emergency from the beginning, and have never failed to respond immediately and with complete satisfaction whenever called upon. The engine has worked perfectly ever since the steam was first admitted to its cylinders, and it is popularly known among the exhibition people as "Big Reliable."

As an instance justifying the giving of this appelation, it may be stated that the St. Louis Transit Company, which operates the larger part of the street car system in St. Louis, has found itself short of power ever since the World's Fair began, for its plant was working at an almost constant fifty per cent overload, and at rush hours the excess reached extreme proportions. The railway company has now applied to the World's Fair authorities for additional power, with the result that Governor Francis and the Fair Administration have, by contract, put at the service of the railway company during the day, from 2 p. m., until 7 p. m., when the loads are heaviest, the service of the "Big Reliable" Allis-Chalmers engine. From 8 p. m. until the Fair grounds close this powerful unit supplies the current for the decorative lighting of the buildings and grounds, which forms the most conspicuous attraction of the exhibition. The lighting requires 200,000 incandescent lamps. The traction load which the engine and generator will now carry by contract between the railway company and the exhibition authorities, will be at least 3,000 horse power, to begin with, and may be much increased as the World's Fair crowds are augmented.

A STEAM ENGINE OF EXCEPTIONAL ECONOMY.

In view of the intense interest at present manifested in the steam economy of prime movers, both of the reciprocating and turbine types, it is impossible to pass without noting some results lately obtained in an official pumping engine test at the Park Avenue Pumping Station, Chicago. The engine is of the Worthington, duplex, reciprocating, triple-expansion type, having semi-rotary steam valves, but no fly-wheel. The latter is replaced by compensating cylinders, so arranged that their pistons retard the motion of the main piston during the first part of the stroke, but assist it towards the close, giving a uniform resultant thrust. The pistons of these auxiliary cylinders work against air under pressure from a tank. The engines are vertical, and the weight of the pistons, plungers and rods is counterbalanced by another auxiliary balancing plunger, also working through the medium of water against air under pressure.

The capacity of the engine is about 22,000,000 gallons per day against a total head of slightly over 121 feet, and 660.9 horsepower was indicated in the test. The duty obtained was 174,735,801 foot pounds per 1,000 pounds of steam used, corresponding to an economy of 11.32 pounds of steam per net horsepower delivered in water lifted, or 10.01 pounds of steam per indicated horsepower. The steam pressure was 144.45 pounds per square inch, with 154° F. superheat at the throttle, the steam cylinders being provided with jackets and re-heaters. Two other engines of the same design in the Central Park Avenue Station and three more in the Springfield Avenue Pumping Station have all shown under test an economy of steam less than 11 pounds, although the economy per delivered horsepower was not as high in the test quoted. These tests were carried out under the supervision of the Bureau of Engineering of the City of Chicago, and, together with the engines and the power station, are fully described in a pamphlet distributed by Henry R. Worthington of New York City.

THE INSECURITY OF OVERHEAD WIRES.

Three tall telegraph poles in the Mission district fell without warning on Thursday, simply because they had become too rotten at the base to stand any longer. One of them did considerable damage to a neighboring residence in its descent. The weather was practically calm at the time. Only a northern zephyr stirred the atmosphere. It was not strong enough to have blown down a straw. So, in the fall of these telegraph poles, the elements had no part and were absolutely blameless.

Many of the streets radiating from the business center of the city are lined with a wall of these tall wooden shafts loaded with scores of wires and cables. They have been universally condemned heretofore, solely on the ground of their unsightliness and their unwelcome obstruction of the sidewalks. The public have overlooked the element of danger which lurks in them and which the incident of Thursday has disclosed. What assurance have we that in these long rows of heavily loaded telephone and telegraph poles stretching for miles on either side of many of the public streets there are not scores of them as rotten at the base as those which fell in the Mission? If there are others of that kind standing, they are not self-supporting and are doubtless held erect by the wires which they are carrying. What may happen to these rotten poles when a gale of wind sweeps over the city is not pleasant to contemplate. Human lives may be sacrificed and much property destroyed. The incident at the Mission certainly points to a laxity in the inspection of the telegraph and telephone poles studding the sidewalks and emphasizes the necessity of a change in this respect or the early removal of all overhead lines by their transfer under the roadways. Perfect security to the public and the absolute suppression of a public eyesore lie in the removal of the poles and in the laying of all telephone and telegraph lines underground.—San Francisco *Chronicle*, September 10, 1904.

G. I. PUNCHED CLIP LEVER SWITCHES.

A new line of knife switches known as "G. I. Punch Clip Lever Switches," has been brought out by the General Incandescent Arc Light Company, especially to meet the demand for cheap and serviceable switches for motor or lighting service in factories or similar installations. They are well made in every particular, all conducting parts being made of pure rolled copper finished by dipping and lacquering and mounted on slate bases in a first-class workmanlike manner so as to meet every Underwriter's requirements. They are made entirely in front connected-lugs but no fuses are furnished in any instance unless otherwise ordered—and as such they will be found entirely satisfactory for all purposes excepting where a highly polished switch is required on account of appearance. These switches are, therefore, furnished in the one style of finish as stated above, and in sizes and types they range in 15, 25, 50, 75, 100 and 150-ampere sizes, in 1, 2 and 3 poles, with and without fuses, single and double throw, and are spaced for 250-volt service.

THE STILLWELL-BIERCE PROPERTY SOLD.

The plant of the Stillwell-Bierce and Smith-Vaile Company, located at Dayton, Ohio, was sold by order of the trustees, on August eleventh, to Colonel J. D. Platt, of Dayton, for $775,000, the sale taking over the good will, equipments, and patterns, as well as the lots conveyed by the Dayton View Hydraulic Company and a small piece of real estate. The property was appraised at $1,265,870. The price at which the sale was made being less than three-fourths of the appraised value, it is necessary for the United States Court to confirm the sale. It is as yet uncertain as to the amount the unsecured creditors will receive.

The property has been operated by trustees for about a year, and will continue in operation, as heretofore, under the new ownership.

O'BRYAN ELECTRICAL COMPANY EXPANDING.

The O'Bryan Electrical Company, Monterey, Cal., will occupy the ground floor and basement of the O'Bryan block, as soon as it is completed; sometime in November. The new quarters will be much larger than those occupied at present, and will be made to accommodate a complete line of gas and electric fixtures and supplies. The basement will be used for a shop. The company has built up a splendid business in Monterey by acting as solicitor for the local gas and electric company, and is enlarging its business to take in other fields. It is making a specialty of acting as contracting agent for gas and electric companies. The success which has attended the company's efforts in Monterey has met with considerable attention.

ESCALATORS FOR A GREAT DEPARTMENT STORE.

Boston's large department store, controlled by the interests of which Henry Siegel is president, is to have the largest equipment of escalators (moving stairways) in the world. The contract has just been signed with the Otis Elevator Company for the installation of ten of these modern appliances. There will be two lines of escalators running between the basement and the fifth floor, five up and five down. By means of special mechanism, the descending escalators can be reversed and utilized to carry patrons of the store to the upper floors in the extremely busy season.

IN NEW QUARTERS.

The Farnsworth Electrical Works has taken up new quarters on the ground floor of the Crossley Building, 111 Jessie Street, San Francisco, moving thereto from 183 Jessie Street. The new quarters have at least six times as much room as the old, and are thoroughly equipped for repairing all kinds and sizes of electrical machinery. The company also engages in renting motors, and buying and selling second-hand apparatus.

In the machine shop, power is secured from individual motors direct-connected to tools. A six-ton traveling crane connects the shop with the shipping department.

THE NERNST LAMP IN COLORADO.

The Nernst lamp is fast becoming introduced in the West as an efficient electric light for all kinds of commercial lighting service. The Denver office of the Nernst Lamp Company, in charge of Mr. R. D. Marthens, has lately received contracts for lighting the United States army posts at Fort Logan, Colorado, and also the Central Drug Company, A. A. Turnace Billiard Hall, and the Schilling Mercantile Company, all of Cripple Creek, Colorado. In each instance, the Nernst lamps replace incandescent systems.

G. I. HIGH-TENSION SWITCHES AT ST. LOUIS.

The General Incandescent Arc Light Company furnished The Frank Adams Electric Company of St. Louis with all of the oil switches used for the distribution of high-tension current at the various buildings of the St. Louis Exhibition. This order was of considerable magnitude.

PERSONAL.

W. H. WHITESIDE

The new management of the Allis-Chalmers Company is certainly drawing to itself a group of the ablest men in their respective lines in the country. The latest acquisition is Mr. Walter H. Whiteside, who has, until within the past few days, occupied one of the most important positions in the Westinghouse organization, having been the manager of the Detail and Supply Department of the Westinghouse Electric & Manufacturing Company, of Pittsburg, and, at the same time, general manager of the Sawyer-Man Electric Company of New York.

But Mr. Whiteside's experience has been by no means confined to the electrical field. His first business connection dates back to 1881, when he entered the employment of the Hercules Powder Company. Four years later he became associated with the Cleveland Electrical Manufacturing Company of Cleveland, Ohio, remaining with that concern nearly twelve years. In 1896 he was appointed manager of Engine Sales for the Gates Iron Works of Chicago and in 1898 the Westinghouse Electric & Manufacturing Company made him the manager of its Washington office, where he became associated not only with the largest electrical projects undertaken in the district which his office covered, but in other places farther afield, for instance in the engineering work in connection with the installation of electrical power in the Dry Docks of the Navy Department, especially at Portsmouth, League Island and Boston. But Mr. Whiteside's best work in the commercial sense was the building up of that immensely successful branch of the Westinghouse Electric organization known as the Detail and Supply Department, into which he injected a new life and vigor of administration that brought an admirable reaping of profitable results and won him recognition for marked executive ability. About a year ago Mr. Westinghouse appointed him general manager of the Sawyer-Man Electric Company of New York, thereby practically doubling his duties, for he continued the management of the Detail and Supply Department of the parent company at Pittsburg. His continued success drew to him the attention of men high-placed in competing lines.

Mr. Whiteside is a man of force and also of delightful personality. There is no man at the commercial end of the great industrial companies better known throughout the country than he. Everyone who has had dealings with him has confidence in him, because everyone knows that he is a man who keeps his word, whether he speaks it or writes it. He would be a strong man for any industrial concern, and it is difficult to know whether to congratulate the more the Allis-Chalmers Company, which has secured his services, or himself for becoming identified with that powerful concern.

Mr. Whiteside's position will be that of general manager of sales for all departments of the Allis-Chalmers Company, including, of course, the Bullock Electric Manufacturing Company, which has become the electrical department of the Allis-Chalmers Company. His experience thoroughly qualifies him for this important duty, which he takes up with the good wishes of his very wide circle of business acquaintances. Mr. Whiteside entered upon his new duties about the middle of July.

Mr. Y. R. Dunbar, formerly with the Maloney Mining Company, has become associated with Mr. E. D. Squire in the power apparatus department of the California Electrical Works.

Mr. Ed. L. Nash, for nine years Eastern sales-manager for the Jandus Electric Company has been appointed district manager for the Philadelphia branch office of The General Incandescent Arc Light Company.

Mr. Roscoe Cornell has been appointed manager of the branch office which the Allis-Chalmers Company has just openeed in El Paso, Texas. Mr. Cornell goes to the Allis-Chalmers Company from the Mine & Smelter Supply Company of Denver.

M. W. Herzog, of Herzog & Dahl, San Francisco, recently returned from a trip through the electrical centers of the Eastern States, where he studied the conditions and advanced methods for the purpose of applying them to the business of his concern.

Mr. Arthur F. Estabrook, formerly with the Union Lumber Company, has opened an office in the Crocker building, San Francisco, to engage for himself in the sale of poles, ties and cross-arms. He has also secured the agency of McCormick Brothers, McCormick, Washington, and the Seattle Timber Supply Company, Seattle.

Prof. A. Van der Naillen, who has for over thirty years conducted the well-known School of Practical Civil, Mining and Electrical Engineering in San Francisco, has just received the high honor of being appointed Commissioner to represent California by the directors of the Belgium World's Fair, which will take place at Liege, from April to November, 1905.

E. A. Rix of the Rix Compressed Air & Drill Company, San Francisco, has returned from the East where he has succeeded in arranging with the Chicago Pneumatic Tool Company for the manufacture and sale of the Torpedo Rock Drill. The Chicago Pneumatic Tool Company will introduce these drills in Europe and America, with the exception of the Pacific Coast, which territory will be retained by the Rix Compressed Air & Drill Company. There will be a stock of drills carried in London, Berlin, Glasgow, Paris, Brussels, Vienna, St. Petersburg, Stockholm, Yokohama and in Sidney, and in nine different cities in America so that this drill will be thoroughly introduced.

NEW INCORPORATIONS.

MONTEREY, CAL.—The Monterey County Gas and Electric Company is in the market for a 150-horsepower gas engine, second-hand.

PETALUMA, CAL.—The Vallejo Township Telephone Company; capital stock, $5,000; incorporators, J. Caltoft, W. Evart, G. W. Ormsby and others.

SAN FRANCISCO, CAL.—The American Fixture Company has been incorporated with $25,000 capital stock, by Ballo Bruetting, H. H. Winner, Geo. Goeppert, J. R. Jenkel and P. O. Peterson.

RENO, NEV.—The Nevada Transit Company; capital stock, $250,000; incorporators, H. E. Reidm, H. J. Gosse and others. The company will construct an electric railroad between Reno and Sparks, Nev.

LOS ANGELES, CAL.—The Globe Power Company has been incorporated; capital stock, $2,000,000; incorporators, C. M. Clark of San Francisco, I. E. Tute, N. S. Sterry, W. E. Dunn and S. M. Haskins of Los Angeles.

ELMIRA, ORE.—The Eugene, Elmira and Florence Telephone Company; capital stock, $1,000; incorporators, J. F. Inman, F. C. Walters and others. The company will carry on a general telephone and telegraph business.

PORTLAND, ORE.—The Mount Hood Electric Company; capital stock, $1,000,000; incorporators, G. W. Waterbury, C. W. Miller and E. D. Whitney. The company will supply electric light, heat and power. C. W. Miller states that the initial plant will cost $500,000.

SAN JOSE, CAL.—The Mount Hamilton Exploitation Company has filed articles of incorporation, capital, $20,000. Incorporators, J. D. Radford, J. L. Benepe and others. The object is to exploit right of way for construction of a railway between San Jose and Mount Hamilton, in Santa Clara County.

EUREKA, CAL.—North Mountain Power Company; capital stock, $500,000; incorporators, J. L. Koster, F. J. Koster, R. J. Tyson, 18 California Street, San Francisco, and others. A site for the power house of the company has been secured near the drawbridge of the California and Northern Railroad, over Eureka slough. Work on the structure will soon be commenced.

SAN FRANCISCO, CAL.—The Shoenberg Electric Appliance Company has been incorporated with $50,000 capital stock, by M. E. and Henry Shoenberg, E. Tauszky, J. and Sydney J. Goldman. The company has established a factory and offices in the Pavia Building, 641 Sutter Street, for the manufacture and sale of electrical appliances and compressed air apparatus for medical and dental use.

PORTLAND, ORE.—Portland Southern Electric Railway Company has been incorporated; capital, $1,000,000; incorporators, L. B. French, W. J. Cook, M. J. Kinney, J. D. Waterbury, C. W. Miller and J. H. Albert. L. B. French, manager of the company, has established headquarters at Salem, Ore. A permanent survey is now being made. The route will follow the Southern Pacific Railroad and will touch all the valley towns except New Era. Power will be obtained from the Sandy River.

EUGENE, ORE.—The Willamette Valley Electric Railway Company has been incorporated by J. F. Wilson of Arizona, M. S. Taff and others. The company has received a franchise from Lane and Benton Counties to build along the county roads a system of electric railways to extend to nearly all parts of the county, covering over 140 miles. Mr. Wilson is making a tour through the districts named to secure data concerning the necessary outlay of money to complete the road.

TRANSPORTATION.

PORTLAND, ORE.—A movement is on foot to construct an electric railroad between East Oregon City and Portland, Ore.

SPOKANE, WASH.—The Cœur d'Alene and Spokane Railroad contemplates building a branch line from its main line to Liberty Lake.

LOS ANGELES, CAL.—The Pacific Electric Company is laying heavier steel throughout the entire length of the old Pasadena car line.

BAKER CITY, ORE.—An electric railway is being contemplated by capitalists of Lincoln, Neb., to be constructed between Sumpter and Bourne, Ore.

NEW WESTMINSTER, B. C.—The car works of the British Columbia Electric Railway Company have been destroyed by fire. The loss is estimated at $30,000.

LEWISTON, IDAHO—The Lewiston-Clarkston Company will construct an electric road to connect Clarkston and Lewiston, and perhaps extend it into some of the outlying districts.

PORTLAND, ORE.—The Portland and City and Suburban Street Railway Companies are to be merged into one company, under the name of the Portland and Suburban Railway Company.

CLACKAMAS, ORE.—C. F. Clark, and other citizens of this place, are promoting a project to build an electric line from East Oregon City, via Clackamas and Milwaukee, to Portland, Ore.

SAN DIEGO, CAL.—The City Council has passed favorably the application for a franchise for a street railway, made by E. Bartlett Webster and Edward Fletcher, and will advertise same.

LOS ANGELES, CAL.—Bonus subscriptions and right of way permits are being obtained by Sierra Madre people for the extension of the Pacific Electric Railway, from Lamanda Park to Sierra Madre.

GREAT FALLS, MONT.—The survey for the proposed electric line to Kendallis, Mont., is completed and all is now in readiness to organize a company and begin work. The cost is estimated at $110,000.

BUTTE, MONT.—It is stated that Joseph Plastina of Spokane, Wash., and F. M. Barrett of Wisconsin, are back of a project to build an electric railway from Libby, Mont., to the mines south of Libby.

SALT LAKE CITY, UTAH—An electric railway line, from Salt Lake to Bingham, Utah, backed by J. G. Jacobs, the builder of the Salt Lake and Mercur road, is one of the possibilities of the near future.

SAN JOSE, CAL.—The Board of Supervisors of Santa Clara County has adopted an ordinance granting a franchise to F. M. Lockwood and J. A. Mehling for a franchise for an electric railroad on the Berryessa road.

BUTTE, MONT.—D. E. McKinnon, secretary and general manager of the Amador Mining and Milling Company, states that his company contemplates building an electric road from Amador, Mont., to the mines of the company.

SAN JOSE, CAL.—The San Jose-Los Gatos Interurban Railway Company has been awarded a franchise by the Supervisors of Santa Clara County for an electric railway along Railway Avenue and Campbell Avenue, bid being $50.

PENDLETON, ORE.—The Eastern Oregon Development Company has secured a franchise to build and operate electric railways along the highways of Union County, Ore. W. E. Davidson of Pendleton, Ore., is secretary of the company.

FRESNO, CAL.—The surveyors for the Huntington road to the Yosemite Valley from Fresno, have reached a point above Crane Valley. This is about half the distance to Wawona. The survey cannot be completed before the last of November.

SANTA ROSA, CAL.—The farmers of the Vine Hill district, headed by Manager Alves of the Vine Hill Vineyards, are considering the matter of inducing the Petaluma and Santa Rosa Railway Company to run its lines through that section.

OROVILLE, CAL.—The Northern California Counties Electric Railway and Steamer line has been organized for the purpose of building an electric railway to connect Marysville, Oroville and Colusa. F. E. Emlay of this city is one of the promoters of the enterprise.

CHICO, CAL.—The Chico Electric Railway Company has been organized; capital, $250,000; incorporators, C. W. Waller, L. J. de Sabla, Rialto building, San Francisco, H. P. Pitts and others. The object is to construct and operate in Chico an electric railroad of standard gage.

HELENA, MONT.—A preliminary survey is being made for an electric railway to run between Lewiston and Kendall. J. L. Bright of Lewiston, Mont., is interested. The construction of the road is contingent upon the amount of power to be needed, and if it can be furnished by the local power plant.

SAN JOSE, CAL.—The promoters of the electric railway up Mount Hamilton to Lick Observatory have decided to incorporate a company with $20,000 capital, to make the preliminary surveys, estimates of cost and secure franchises. After the necessary work is done, an effort will be made to sell bonds in the East for its construction.

SAN FRANCISCO, CAL.—The California Gas and Electric Corporation will supply power to the companies which are building street railway lines in Sonoma and Lake counties, Cal. The line between Petaluma and Santa Rosa is nearing completion. The same line will later be extended to Healdsburg and Cloverdale. Another line is being built from Petaluma through Sebastopol to Santa Rosa. The Cloverdale and Clear Lake Electric Railway Company has completed surveys between Cloverdale and Lakeport.

TRANSMISSION.

MOYIE, B. C.—R. E. Kinsey is interested in a company, to organize with $25,000 capital, to establish an electric light and power plant near here. Power will be secured from the falls of Lamb Creek. It is proposed to develop 550 horsepower.

SEATTLE, WASH.—Plans have been filed in the office of the inspector of buildings of Seattle for the construction of the substation of the municipal lighting plant. Work on the pole line will soon begin. The estimated cost of the building is $22,000. Address, W. N. G. Place.

RIVERSIDE, CAL.—M. Machado and J. H. Cameron have appropriated 2,000 inches of water in the Santa Marguerita River, flowing through Temescal Canyon, near this city. The water is to be used for generating electricity, to be transmitted to Fallbrook, San Diego County.

JOHN DAY, ORE.—The Empire Gold Dredging Company is preparing to install a hydro-electric plant near here, which they will operate with water taken from the John Day River. The company is determining the flow by gaging same over a weir dam. The power will probably be used for operation of dredgers, machine shop, etc.

LOS ANGELES, CAL.—The Edison Electric Company has been granted permission by the Council to erect steel towers along the bank of the Los Angeles River, to be used for carrying cables to convey electric power from Kern River to Los Angeles. The towers will be 65 feet high.

SALT LAKE, UTAH—Regarding the report that the Utah Light and Power Company is contemplating the building of another plant in American Fork canyon, John C. Cutler, of the company, states that his company has recently installed additional machinery, and while it has secured rights in the American Fork canyon, there will be nothing done toward further development this year.

PORTLAND, ORE.—The Oregon Water Power and Railway Company has started work on the construction of an electric light plant on the Clackamas River, near Cazadora, Oregon. It is understood that a half a million dollars will be spent on the plant.

SAN FRANCISCO, CAL.—The Shasta Power Company has placed the contract for its electrical equipment with the San Francisco office of the Kilbourne and Clark Company. The equipment includes two 750 kilowatt generators with 14 transformers, together with the complete switchboard equipment for generating and sub-stations. The apparatus will be manufactured by the National Electric Company at its Milwaukee works.

REDDING, CAL.—H. L. Shannon of the Shasta Power Company, headquarters Crossley building, San Francisco, has applied to the Board of Supervisors of Shasta County for a franchise to erect and maintain poles and string wires for the purpose of conducting and transmitting electricity along the roads of Shasta County. Bids for said franchise will be received by the board up to 10 a. m. September 6th. W. O. Blodgett is the County Clerk.

MARYSVILLE, CAL.—Water appropriations have been filed in this city by Jason R. Meek and M. P. Vieira, the former for 30,000 inches of water in Dry Creek, to be conducted to the Oregon House Valley, where a reservoir will be constructed, thence to Township 16, where it will be used for the generation of power for electrical purposes and for irrigation. Mr. Vieira filed on 20,000 inches from the same stream, a mile north of Oregon House.

REDDING, CAL.—The Northern California Power Company is extending its transmission lines in Shasta County. The company will run a new line from its sub-station at the Mt. Shasta mine, on Clear Creek, near Shasta, to the Mountain Lion mine, on Clear Creek, about a mile distant. A second extension will be constructed from the company's sub-station, at the Afterthought mine, on North Cow Creek, down that stream one mile, to the smelter of the Great Western Gold Company.

LOS ANGELES, CAL.—A. J. Morganstern, with offices also in the Parrott building, San Francisco, and at 455 S. Broadway, Los Angeles, is at the head of a syndicate that has projected a plan to develop the waters of the San Joaquin River, above Pollasky, in Fresno County, and generate electricity for the surrounding agricultural and mining section. It is planned to cut a tunnel three miles long through the mountain sixteen miles above Pollasky, which will divert 500 cubic feet of water a second from the San Joaquin River, and assure the development of 15,000 horsepower at the generating plant. It is stated that the syndicate has already secured control of the Fort Miller Power Company, which was organized in 1900, and which made extensive surveys for determining the most available method of utilizing the power of the San Joaquin River, and it is now announced that the plans have been agreed upon for the completion of the project. The undertaking will involve the expenditure of about $1,000,000.

COMMUNICATION.

SONOMA, CAL.—L. Breitenbach has secured a franchise from the Trustees of Sonoma for a telephone system.

SALEM, ORE.—An effort is being made to improve the telephone service here. The Pacific States' expert is expected soon, when the matter will be taken up.

SANTA MONICA, CAL.—The Home Telephone Company is rushing work on its long-distance trunk line. A franchise will probably be asked for within a short time.

SAN JOSE, CAL.—The Rucker and Orchard districts in Santa Clara County are to have a telephone system like the one in operation in the Uvas district. Holmes Brothers are the promoters.

MONROE, WASH.—The City Council has passed an ordinance granting to the Sunset Telephone and Telegraph Company the right to erect poles and maintain wires for the transmission of electricity for telephone and telegraph purposes in that town.

SAN DIEGO, CAL.—The plant of the Sunset Telephone Company is to be reconstructed under the direction of Resident Manager Lewis. All overhead wires and poles in the fire district, from B to J Streets, and from Second to Seventh Streets, are to be taken down and placed in an underground conduit system. Two new circuits are being installed for the La Jolla branch of the service. The matter of the extension of the San Diego line across the desert to Imperial is also being considered.

ILLUMINATION.

SAN FRANCISCO, CAL.—The Drendel Switchboard Company has secured the contract for eight switchboards, aggregating 160 circuits, from Roos Brothers.

ARANDAS, MEX.—An electrical plant is to be established by Porfirio Torres Camarenas, a resident of Guadalajara. Steam power will be used.—*Monterey, Mex., News.*

SAN FRANCISCO, CAL.—The California Electrical Works has been awarded the contract for thirty-five enclosed arc lamps, to be operated on the direct-current, constant-current circuits of the San Luis Obispo Gas and Electric Company.

SAN FRANCISCO, CAL.—The San Francisco Light Company, recently organized, has opened a salesroom at 314 Post Street, where a complete stock of gas and electric lighting fixtures and appliances is carried. George R. Kibbe is manager of the company.

SAN FRANCISCO, CAL.—The Nernst Lamp Company has opened a district sales office at 519 Mission Street, with W. G. Clark as district manager, and H. G. Aylsworth as office manager. The company will also have a maintenance bureau to keep in order lamps which have been installed.

SAN FRANCISCO, CAL.—The California Electrical Works has received a contract from the Standard Electrical Construction Company for one 7-panel and one 2-panel switchboard, to be installed in the new Flood building. These switchboards will be built by the Western Electric Company, Chicago.

SAN FRANCISCO, CAL.—The Decker-Fagan Company, composed of Peter Decker and William A. Fagan, both of whom have been connected with the National Electric Company for a number of years, has been organized to engage as electrical contractors. The company is located at 183 Jessie Street, where it will also carry a line of supplies, making a specialty of telephones.

FINANCIAL.

BUSINESS OUTLOOK.—There is a decided tendency to view the future with less pessimism than that which obtained during the summer months. While the amount of business being closed is not in such volume as during the boom period, it is in sufficient quantity to indicate a healthful condition. There is a noticeable increase in inquiries, and of such a nature as to give promise of a broader market. The number and size of companies organizing to engage industrially throughout the West, and the plans that have been formulated and carried through for increasing capacities of existing plants, is on such a scale as to convince the most skeptical of an indefinite continuance of prosperity.

The peculiar locations of the Western and Pacific Coast trade centers are such that they are effected only in an indirect way by the leading Eastern centers. There is considerable more tone to business in the middle West and Atlantic Coast States, where industries have been undergoing a readjustment of prices in all staple commodities. However, some hesitancy is shown on the part of buyers in the East to place stock orders. Particularly is this the case in finished and semi-finished lines of iron and steel, notwithstanding the efforts of the leading interest to bolster up the market by insisting that prices are at the bottom.

A controlling interest in the Hanford Oil Company was sold to John Martin of San Francisco, September 2d. There are 2,000 shares in the corporation. The conditions of purchase provide for a cash payment of $50 per share, with 5 per cent interest on the balance of $160 per share for nine months, this balance to be paid on June 1, 1905, otherwise the $50 per share to be forfeited. As the Hanford is a regular dividend paying company, the dividends during the coming nine months will be held in escrow, and when final settlement is effected will be turned over to the purchaser or deducted from the balance due on the purchase price. The secretary of the company has been instructed to notify all holders of the remaining one-third of the stock that if they so desire they can place their shares with the Central Trust Company and receive $210 per share at the same time the controlling two-thirds are paid for.

The Hanford company is one of the best-known oil producers in the State. It has seven wells in operation and one now being drilled. The stock was never assessed, and, while $70,000 has been expended in improvements, $30,000 has been paid in dividends. Three-quarters of the section are leased to other oil companies, the Independence, which has nine wells; the Oil City Petroleum, ten wells; the Twenty-eight, twelve wells, and the Stockholders, two wells. These companies pay a one-eighth royalty to the Hanford company, which for some time has aggregated $4,000 per month, and the entire income of the last-named company is close to $9,000 per month.

The leases of these four companies have fourteen years yet to run, after which all their wells and other improvements revert to the Hanford company. The officers of the company are Daniel Finn, president; E. M. Walsh, vice-president; S. Rehoefer, treasurer, and P. McRae, Joseph Weisbaum and F. P. Pryor.

MISCELLANEOUS.

LOS ANGELES, CAL.—The recent storms have damaged the substation of the Pacific Light and Power Company, at Covina, the transformers being a total loss.

SAN FRANCISCO, CAL.—The G. W. Price Pump Company received an order, aggregating $15,000, for centrifugal pumps, for reclamation district 44. The company is also furnishing a 36-inch pump to Mr. Newell, of Stockton.

SAN FRANCISCO, CAL.—The construction department of the Electric Storage Battery Company has been removed to 635 Howard Street, San Francisco. The new quarters are much larger than those formerly occupied, and in them complete parts of storage batteries are carried in stock for prompt repairs.

SAN FRANCISCO, CAL.—The Continental Paint and Varnish Company has started work on the construction of a factory on Twelfth Street. The officers of the company are: W. N. Benedict, president and general manager; W. H. Hoyt, secretary and superintendent, and A. M. Freeman, vice-president and treasurer.

SAN FRANCISCO, CAL.—The United Iron Works is building a two-step pressure pump of 150 gallons capacity to be sent to the City of Mexico. The company is also building one two and one three-step pressure pump for Biggs and Antioch, Cal., waterworks, of 400 gallons capacity. One is to operate against a head of 190 feet and the other against a head of 225 feet.